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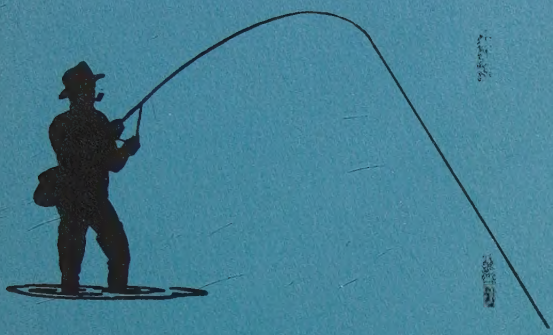

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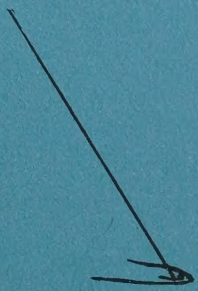

Vol. 11, No. 2, 1966

Abstracts 8501 - 8700

DEPARTMENT OF THE INTERIOR

U. S. FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

DEPARTMENT OF THE INTERIOR

Stewart L. Udall, Secretary

U. S. FISH AND WILDLIFE SERVICE

Clarence F. Pautzke, Commissioner

BUREAU OF SPORT FISHERIES AND WILDLIFE

John S. Gottschalk, Director

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Washington, D. C.

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Vol. 11, No. 2 Abstracts 8501-8700 1966

Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

One volume consisting of four numbers is issued each year. Each number contains separate Author and Subject indexes. The final number of each volume contains cumulative Author and Subject indexes and a list of publications screened.

Suggestions for improving the usefulness and scope of Sport Fishery Abstracts are solicited.

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George R. Lee, Editor
Ronald C. De Vall, Asst. Editor

8501. Bullock, G. L., S. F. Snieszko, and C. E. Dunbar (Eastern Fish Disease Lab., Leetown, W. Va.). 1965. CHARACTERISTICS AND IDENTIFICATION OF OXIDATIVE PSEUDOMONADS ISOLATED FROM DISEASED FISH. Jour. General Microbiology, 38(1): 1-7.

Several characteristics of 20 strains of oxidative pseudomonads, all but one of which were isolated from freshwater fish, were determined. All strains oxidized glucose and gluconate, produced NH_3 from 1% peptone, grew at 6, 12, 20 and 30° and produced cytochrome oxidase. Lipase was produced by 17 of the strains, while 15 produced gelatinase and 16 produced fluorescent pigment. These and other characteristics used to identify fish-spoilage pseudomonads are also useful for identification of fish-pathogenic pseudomonads. Species determinations from the present data were not attempted. However, from previously published data on speciation of Pseudomonas, most of the 20 strains appeared to be closely related to or identical with P. fluorescens. (Authors)

8502. Atkins, Buell O., and Farrell F. Copelin (Okla. Dept. Wildlife Conservation, Oklahoma City). 1963. NEW FISH AND WILDLIFE MANAGEMENT AND RESEARCH OPPORTUNITIES IN OKLAHOMA. In: Fifty-first Annual Meeting of the Oklahoma Academy of Science, Tulsa, 7-8 December, 1962. Proc. Oklahoma Acad. Sci., 43: 227-229; Biological Abstracts, 46(24): Abst. No. 105501. 1965.

Opportunities are described for fish and wildlife management and research in conjunction with small watershed flood prevention projects and the Washita River Basin Watershed research project in Oklahoma. (Authors)

8503. Prokov'eva-Bel'govskaya, A. A. (Inst. Radiat. Physicochem. Biol., Acad. Sci. USSR, Moscow). 1964. HETEROCYCLICITY OF THE CELL NUCLEUS SYSTEM AT EARLY STAGES IN THE DEVELOPMENT OF Salmo faria, Salmo salar, AND Coregonus lavaretus baeri. Tsitologiya 6(5): 553-559. Illus. (Eng. summ.); Biological Abstracts, 46(24): Abst. No. 105728. 1965.

A study of the cell nucleus at early stages of development of Salmo faria L., S. salar L. and Coregonus lavaretus baeri (5-6 days) showed that parent chromosomes, up to the stage of middle gastrula, remain isolated and up to the late blastula differ from each other in many respects, such as: the nature of spiralization in prophase chromosomes, the time of their mitotic reorganizations and sometimes the intensity of their nuclear reaction. During prophase the parent chromosomes form 2 separate skeins of threads oriented towards the opposite cell poles. Parent metaphase chromosomes in many blastomeres are oriented in different plates. In the late blastula the parent chromosomes differ distinctly in their ability to form the material of nucleolus. While investigating chromosomes at the gastrula stage in irradiated embryos of Salmo salar L. (X-ray, 800r, stage of 8 blastomeres) differential damage of parent chromosome complexes was found. This could be connected with a difference in their cyclic states at the time of irradiation. These data are considered in the light of the hypothesis offered by the author in 1948, according to which heterocyclicity of the system of the cell nucleus is evolutionarily fixed by characteristics in the development and structure of gamete nuclei and plays a fundamental role as a factor constituting the high metabolic properties of the cell. (Auth.)

8504. Conte, Frank P. (Radiat. Center, Oregon State Univ., Corvallis). 1965. EFFECTS OF IONIZING RADIATION ON OSMOREGULATION IN FISH Oncorhynchus kisutch. Comp Biochem Physiol 15(3): 293-302. Illus.; Biological Abstracts, 46(24): Abst. No. 106011. 1965.

Decreased survival occurred for juvenile coho salmon following doses of X-radiation >1000 r when transferred from hypo-osmotic to a hyperosmotic environment (0 °/oo - 30 °/oo salinity). Survivors which had remained in salt and fresh water 60 days post-irradiation were sacrificed for plasma sodium, chloride and osmotic concentrations. Increased levels ($P < 0.005$, > 0.01) were noted between the control (0 r) and the irradiated (>1200 r) group of salt water fish; while no significant elevations occurred between irradiated and non-irradiated fish remaining in fresh water. Sites of histopathological changes in salt water fish were found

principally in the extrarenal system (gills, caecae and intestine) with severe damage noted in the gill lamellae. No damage was apparent in the kidney. No histopathological changes were noted in fish receiving the same amount of irradiation but which remained in fresh water. (Auth.)

8505. Solovkina, L. N. (Inst. Biol., Komi Br. Acad. Sci. USSR, Syktyvkar). 1964. GROWTH AND SUMMER FOOD OF YOUNG ATLANTIC SALMON (Salmo salar) IN THE PECHORA PIZHMA. Zool. Zh. 43(10): 1499-1510. Illus. (Eng. summ.); Biological Abstracts, 46(24): Abst. No. 106273. 1965.

In the river Pechorskaya Pizhma (Pechora tributary) the parr dwell in the middle portion of the river bed where the main spawning grounds of salmon are situated. In summer the majority of young salmon feed in the rapids. The bottom of the feeding grounds is composed of pebbles and stones on which filamentous algae, Fontinalis and Nostocaceae are often growing. Ninety percent of the food organisms and 75 percent of the weight consisted of the following insect larvae: Trichoptera; Ephemeroptera; Plecoptera; Coleoptera; Tendipedidae, Simuliidae, and other Diptera. The imagines of these and other insects, Hydracarina, Mollusca, Nostocacea, fishes (Phoxinus phoxinus and small Cottus gobio) formed the remainder of the food. The male to female ratio in catches of young salmon is almost 1:1. Females were aged 1+ to 3+, males 2+ to 4+. All males were mature. At the maturity stage of the gonads III-IV and IV the average ratio of maturity was 17.6, the maximal ratio 22.3%. No sexual difference in the sizes could be found. The average condition coefficient by Fulton in the age group 2+ in immature females was 1.40, in ripening male parr, 1.62. (Auth.)

8506. Turner, Neely (Conn. Agr. Exp. Sta., New Haven, Conn.). 1965. DDT IN CONNECTICUT WILDLIFE. Conn. Agr. Exp. Sta. New Haven Bull. 672. 1-11; Biological Abstracts, 46(24): Abst. No. 106321. 1965.

The DDT content of fish, birds, and mice was determined from sections of the state in which DDT had been applied by aircraft, and from unsprayed areas. Fish and birds from sprayed areas contained more DDT on the average than those from unsprayed areas, although there was much variation. The amounts in wildlife from the unsprayed area were: whole fresh fish 0.1 to 0.9 ppm; viscera of birds less than 0.1 to 0.6 ppm; in shellfish from 0.031 to 0.07 ppm, and in mice from 0.03 to 0.73 ppm. The food of wildlife from unsprayed areas contained from 45 to 60% as much DDT as from sprayed areas. The source of the contamination seemed to be airborne DDT. There was poor correlation between amount of DDT applied and DDT content of wildlife. (Auth.)

8507. Morris, Robert W. (Dept. Biol., Univ. Oregon, Eugene). 1965. THERMAL ACCLIMATION OF METABOLISM OF THE YELLOW BULLHEAD, Ictalurus natalis (Le Sueur). Physiol Zool 38(3): 219-227. Illus.; Biological Abstracts, 46(24): Abst. No. 106544. 1965.

Separate experimental lots of specimens were acclimated at 12°, 17°, 22°, and 27° C. Metabolism was respirometrically measured in terms of ml. O_2 consumed/g/hour, in a flowing water respirometer. Metabolism of the members of each acclimation group was measured over the range 7° to 27° C. The animals ranged from 1.4 to 11.7 g, wet weight. Body size was found to be significantly related to metabolic rate only when measured at an intermediate temperature after acclimation to that temperature. The species demonstrates a well developed ability to acclimate to both heat and cold. No size related differences were found in acclimation ability. Acclimation to high temperature results in a strong downward displacement of the acutely measured rate-temperature curve without any increase in its slope. (Auth.)

8508. Hoffman, Glenn L., Robert E. Putz, and Clarence E. Dunbar (Bur. Sport Fish. and Wildlife, Eastern Fish Disease Lab.; Leetown, W. Va.). 1965. STUDIES ON Myxosoma cartilaginis n.sp. (Protozoa: Myxosporidea) OF CENTRARCHID FISH AND A SYNOPSIS OF THE Myxosoma OF NORTH AMERICAN FRESHWATER FISHES. Jour. Protozool. 12(3): 319-332. Illus.

Myxosoma cartilaginis n. sp. is described from the cartilage of Lepomis macrochirus (bluegill), L. cyanellus (green sunfish), and Micropterus salmoides (largemouth black bass). The development of the parasite is described from naturally infected fish which were held in spore-free water after infection. The sporoplasm invades cartilage, and becomes a multinucleate trophozoite which forms pansporoblasts, each of which produces 2 to 4 spores. The first spores appear in 7 weeks. The histopathology in the above fish consists at first of little cellular reaction, but after 4 to 5 months epithelioid granulomas appear around some of the spore masses. Cartilage liquefaction is present around the parasites for at least 5 weeks. Eosinophilic globules are present in cartilage cells adjacent to the lesions. Diffuse infiltration of the spores from the lesions is described. Of 24 chemicals tested for polar filament extrusion, potassium hydroxide gave the best results. An illustrated synopsis of the Myxosoma of North American fishes is given. Included is some additional information and illustrations of M. hoffmani Meglitsch, 1963. Also included is a table showing the hosts, site of infection, geographic location, spore and polar capsule sizes. (Authors)

8509. Belova, A. V. 1965. THE EFFECT OF TRANSPORT CONDITIONS ON THE BLOOD COMPOSITION OF THE FRY OF HUMPBACK SALMON GROWN AT THE MURMAN FISH HATCHERIES. Dokl Akad Nauk SSSR Ser Biol 161(2): 466-468; Biological Abstracts, 47(1): Abst. No. 704. 1966.

Analysis of blood of fry from the hatchery, from polyethylene bags and fry transported by helicopter revealed the exclusive presence of secondary erythrocytes and immature products of secondary erythropoiesis, which is entirely normal for the given developmental stage. However, maintaining the fry under the conditions of the experiment resulted in a considerable increase in the content of phagocytes (monocytes and leucocytes with polymorphic nuclei). The content of such elements was also considerably greater in fish from the hatcheries than in those taken from the Ura River. Under crowded conditions in polyethylene bags there was a decrease in the lymphocyte content and an increase in the monocyte content and the content of cells with polymorphic nuclei. Prolonged oxygen deficiency first resulted in these lymphatic changes and then began to affect the red blood. Similar changes were observed in helicopter transport. --N. Fedoroff.

8510. Gordeeva-Pertseva, L. I. 1964. CHANGES IN THE FOOD SUPPLY AND THE FOOD OF PLANKTON-EATING FISHES IN POLYCHLORPINENE-TREATED WATERS. In: Rybnoe khozyaistvo Karelii. (Karelian Fisheries). Petrozavodsk. 8. 53-64. From: Ref Zh Biol, 1964, No. 23I41. (Translation); Biological Abstracts, 47(1): Abst. No. 705. 1966.

Studies on stocking Lake Fardinyarvi and 3 smaller bodies of water showed that fish could live and feed in these waters within 10 months after the introduction of polychlorpinene in a fairly high concentration (0.2 mg/l), and that a high concentration of polychlorpinene caused a reduction in the growth rate of the fish. Low concentrations had less deleterious effects. Following the introduction of polychlorpinene in a dose of 0.2 mg/l, the zooplankton was fully restored within 1 year. No significant changes were observed when the concentration was 0.07 mg/l. In Lake Fardinyarvi, at a polychlorpinene concentration of 0.15 mg/l, the zooplankton was fully restored at 10 months. Liming and fertilizing increased the zooplankton biomass in the lake. Cisco eggs, larval carp and peled (Coregonus peled) were put into Lake Fardinyarvi 8-9 months after the polychlorpinene was introduced. The young of carp and peled thrived in the lake. Carp fed on Eurycercus, Alona, and Daphnia longinspina; peled, on D. longinspina and copepodid stages of Cyclops and Eudiaptomus.

8511. Meade, Thomas G., and Ivan Pratt (Dept. Zool., Oregon State Univ., Corvallis). 1965. DESCRIPTION AND LIFE HISTORY OF Cardicola alseae sp. n. (Trematoda:Sanguinicolidae). Jour. Parasitol., 51(4): 575-578. Illus.; Biological Abstracts, 47(1): Abst. No. 4607. 1966.

Cardicola alseae is a blood-dwelling trematode found in the fishes Salmo clarkii Richardson and Salmo gairdnerii Richardson. The ovoid and nonoperculate eggs

leave the adult and pass to the gill capillaries of the secondary lamellae. The miracidia apparently are ingested by the snail Oxytrema silicula (Gould), and sporocysts develop in the visceral mass. No mother sporocyst generation was identified. Percentage of infection was low, with infected snails having sporocysts of equal size in which furcocercous, lophocercous cercariae develop. A delicate dorsal fin extends at least three-fourths the length of the cercarial body. On contact with soft parts of a potential fish host, the cercaria penetrates within 15 to 20 min. The adult fluke was removed from blood vessels of the gills, liver, mesenteries, and kidneys. It is covered with small spines, possesses a highly saccular testis, subterminal mouth, and H-shaped intestine, and lacks a pharynx. Cardicola alseae is one of three blood flukes found in salmonid fishes and differs from the other two in morphology of the cercaria, size of the adult worm, number of rows of marginal spines, and shape of the testis, ovary, excretory bladder, and intestine. Sanguinicola davisi Wales, 1958, and Sanguinicola klamathensis Wales, 1958, are transferred to the genus Cardicola, becoming Cardicola davisi (Wales, 1958) comb. n. and Cardicola klamathensis (Wales, 1958) comb. n. (Authors)

8512. Cherfas, B.I., L. D. Ivanova, and R. Ya. Kosyreva. 1958. BIOTECHNIQUES OF POND BREEDING YOUNG SALMON. Tr. Moskov. Tech. Inst. Rybn. Promyshlennosti i Khoz. 9. 178-188; Referat Zhur Biol 1959, No. 35110. (Translation); Biological Abstracts, 47(2): Abst. No. 5619. 1966.

The breeding of young salmon in the Chernorechenskii fishery ponds have shown that in the absence of sufficient live food in the diet, 20-30% non-living matter can be introduced (silkworm cocoons, blood, and fish meal) even in the early stages of breeding. The 24-hour food ration should consist of 4% for fish under 1-year-old and 2% for 1- and 2-year-olds (the temperature being 10-12° C). The food should be fine-ground to be easily accessible to the fish. For the less than 1-year and 1-year-old groups, feeding twice a day is suggested. A sharp differentiation of the young fish in the size and weight in relation to the hereditary features and sex differences was recorded. In order to avoid cannibalism, it is recommended that the young be sorted according to size. --Courtesy National Science Foundation (P.L 83-480) 1963.

8513. Hiltibran, Robert C. (Illinois Natural History Survey, Urbana). 1965. OXIDATION OF SUCCINATE BY BLUEGILL LIVER MITOCHONDRIA. Trans. Illinois State Acad. Sci. 58(3): 176-182; Biological Abstracts, 47(2): Abst. No. 5930. 1966.

The succinic oxidase system of bluegill (Lepomis macrochirus) liver mitochondria was investigated. Neither oxygen nor phosphate uptake was metal-ion dependent, but magnesium and ferric ions increased oxygen uptake. Zinc and cadmium ions inhibited oxygen uptake. Bicoumarol, gramicidin, 2, 4-dinitrophenol, and pentachlorophenol uncoupled phosphorylation from succinate oxidation but also inhibited oxygen uptake. Antimycin A, sodium azide, and sodium cyanide inhibited oxygen uptake. (Auth.)

8514. McDonald, Arthur L., and Norman W. Heimstra (Univ. of South Dakota, Vermillion). 1965. AGONISTIC BEHAVIOR IN SEVERAL SPECIES OF FISH. Psychol Rept. 16(3, Pt. 1): 845-850; Biological Abstracts, 47(3): Abst. No. 10501. 1966.

Seven species of fish were studied in an attempt to determine interspecies differences in the amount and type of agonistic behavior shown. Fish in each species were paired and the frequency of attacks shown during a 5 minute observation session was recorded. An observation session was held for 16 pairs of fish of the same species on 5 consecutive days. It was found that bluegill showed the highest frequency of attacks, then green sunfish, largemouth bass, rainbow trout, black crappie, and yellow perch in that order. No attacks were recorded for walleyes during any of the observation sessions. Qualitative differences shown in agonistic behavior among the various species are also discussed. (Authors)

8515. Nikiforov, N. D. 1958. OXIDATION PROCESSES IN THE DEVELOPMENT OF SALMON DEPENDENT ON ENVIRONMENTAL CONDITIONS. Tr. Soveshch. Ikhtiol. Komis. Akad. Nauk SSSR 8. 339-345; Referat. Zhur., Biol., 1959, No. 39864. (Translation); Biological Abstracts, 47(3): Abst. No. 10721. 1966.

Sharp fluctuations of temperature depress the development of the eggs of Salmo salar. An increase in temperature from 1 to 25° C increases the consumption of O_2 by the fry of lake salmon. The slightest augmentation in consumption of O_2 following an increase of temperature of 1° was observed within the optimal range of temperature. Considerable increase or decrease of pH depresses the respiration of the fry of Baltic salmon. The effect of the changes in pH on respiration depends on the chemical composition of substances changing pH. The resistance of the fry of S. salar to salinity undergoes changes with their age. Larvae can live in 5 - 7%, actively feeding fry up to 10%, and descending smolts up to 15%. An increase in salinity within these limits increases the consumption of O_2 and improves growth. --Courtesy National Science Foundation (PL 83-480) 1963.

8516. Sultanov, S. Z. 1964. RESEARCH ON PERNICIOUS ANEMIA IN SALMONIDAE AT TROUT FISHERIES OF USSR AND SALMON FARMS OF THE AZERBAIDZHAN SSR. Izv Akad Nauk Azerbaidzh SSR Ser Biol Nauk 5. 113-131. Illus.; Biological Abstracts, 47(3): Abst. No. 10744. 1966.

The author collected comparative epizootological data relating to diseases of Salmonidae symptomatic of pernicious anemia at several trout and salmon farms across the USSR. Conditions at each farm are described briefly and evaluated in relation to the disease-prevention value of sanitation standards at each facility. Nutritional data compiled by the author lead him to conclude that pernicious anemia in Salmonidae is not a nutritionally attributable disorder, but an infectious disease of viral origin. Specimens of internal organs taken from fish with symptoms of pernicious anemia were analyzed and results are to be reported separately. Several tables illustrate the mortality of roe, larval stages and breeders, as well as the nutrition programs in effect at the various fish farms. --B. LeBental.

8517. Tugarina, P. Ya. 1958. BAIKAL GRAYLINGS. In: Fish and Fishery in basin of Lake Baikal. Irkutsk. 311-333; Referat. Zhur., Biol., 1959, No. 76024. (Translation); Biological Abstracts, 47(3): Abst. No. 10749. 1966.

Two grayling subspecies live in Lake Baikal: the black grayling (Thymallus arcticus baicalensis) and white grayling (Thymallus arcticus baicalensis brevipinnis). Both are found everywhere in Lake Baikal, but the largest concentrations of white grayling were recorded in the areas where large tributaries flow into the lake. White graylings grow more rapidly than black graylings. The latter feeds on gammarids and on caddisflies; the former, according to its habitat, feeds on caddisfly larvae, flying ants, and goby fry. Individually, the white grayling is more fertile; it matures 2 - 3 years later than the black grayling. Spawning of both subspecies occurs simultaneously. Grayling fishing in Lake Baikal is described. In order to increase its reserves, it is necessary to breed grayling artificially and to protect its spawning places. --Courtesy NSF (PL 83-480) 1963.

8518. Dyk, Vaclav (Vysoke Sk. Zemedel., Brno, Czechoslovakia). 1965. INVASION OF THE DIGESTIVE TRACT OF THE TROUT BY THE Crepidostomum farionis. Biologia (Bratislava) 20(6): 417-422. Illus. (Ger. and Russ. summ.); Biological Abstracts, 47(3): Abst. No. 14528. 1966.

The invasion cycle of the digestive tract of trouts by the Crepidostomum farionis was studied. The juvenile stage of C. farionis penetrates from the stomach into the gall bladder, where it stays on occasion past the juvenile stage. The average length of the adult parasites found in trouts from the High Tatras was 1.5 - 3 mm, exceptionally up to 8 mm. --J. Burnett.

8519. de Graaf, F. (Aquarium Roy. Zool. Soc. "Nat. Artis Magistra", Amsterdam, Netherlands). 1962. A NEW PARASITE CAUSING EPIDEMIC INFECTION IN CAPTIVE CORAL FISHES. In: 1st International Congress of Aquariology, Monaco, 1960. Bull Inst Oceanog Monaco Spec. No. 1A 93-96. (French and

German summ.); Biological Abstracts, 47(3): Abst. No. 14634. 1966.

A new parasitic ciliate is described, which causes lethal skin infection in captive coral fishes. The clinical symptoms of the infection may be compared with the "white-spot" disease caused by Ichthyophthirius multifiliis. The reproductive cycle of the new parasite is also similar to that of Ichthyophthirius. The disease may be controlled by trypaflavine in a concentration of 1 g to 100 l of tankwater. Another effective treatment consists of administering 1 g of chinine-hydrochloride to 50-75 l of tankwater, repeating this dose every 4th day, until all symptoms of the infection have disappeared. Between 2 doses the tankwater has to be changed completely. A case in which fishes acquired a certain immunity towards the parasite is described. The taxonomic description of the new species of ciliate will be published eventually. (Auth.)

8520. Frost, Winifred E. (Freshwater Biol. Assoc., Ambleside, England). 1965. BREEDING HABITS OF WINDERMERE CHAR, Salvelinus willughbii (Gunther), AND THEIR BEARING ON SPECIATION OF THESE FISH. Proc. Roy. Soc. Ser. B. Biol. Sci., 163(991): 232-284. Illus. Map; Biological Abstracts, 47(4): Abst. No. 19883. 1966.

Windermere char, Salvelinus willughbii, are either (1) autumn spawners, main breeding period November, most spawning on the lake shore, in shallow water, some in the main inflowing stream; or (2) spring spawners, main breeding period February-March, spawning in the lake only and in deep water. The comparison of these two is mainly based on the autumn spawners netted on the lake spawning grounds at Low Wray Bay and Red Nab, and on a river spawning ground in Brathay, At Purdom's Dub, and on the spring spawners netted on the spawning ground at Holbeck Point. Information on their breeding habits was obtained by rearing fish in hatchery ponds and on their spawning behaviour by observation in the field and in aquaria. This paper, which deals with the breeding habits of the two types of spawners and the implications arising from them, is divided into two parts, with the Discussion in between. Part I describes the breeding habits of the autumn and spring spawners and shows how these separate the two types from each other. It is concerned with the question of whether these autumn and spring spawners so isolated represent distinct populations. (There is a note on the char from other English Lake District waters). The Discussion comes at the end of Part I. Part II gives further details of breeding habits of autumn and spring spawners and describes early stages in the life history of the char. Aspects of the reproductive life of autumn and spring spawners are compared between themselves and also with other Salmonidae. (Auth.)

8521. Norris, David O., and Aubrey Gorbman (Dept. Zool., Univ. Washington, Seattle). 1965. RADIOTHYROIDECTOMY OF LARVAL STEELHEAD TROUT. Proc. Soc. Exp. Biol. Med., 119(4): 1205-1207. Illus.; Biological Abstracts, 47(4): Abst. No. 16692. 1966.

A simplified procedure for radiothyroidectomy of large numbers of juvenile steelhead trout (alevins or fry) is described. Complete destruction of thyroid tissue was achieved 8 to 14 weeks after immersion in a solution of radioiodine in lake water (initial concentration: 12.5 or 25 μc I-131/cc for 8 days). (Authors)

8522. Bachon, William. (Univ. Omaha, Biol. Dept., Omaha, Nebraska). 1965. SIZE, SHAPE, NUMBER, AND DISTRIBUTION OF PERIBLAST NUCLEI IN THE MUSKELLUNGE EMBRYO (Clupeiformes: Esocidae). Trans. Amer. Microscop. Soc., 84(1): 80-86. Illus.; Biological Abstracts, 47(4): Abst. No. 15236. 1966.

Whole periblast nuclei up to 125 μ long were visible in periblast in situ on the yolk of Esox masquinongy ohioensis embryos that had been fixed in ethanol-acetic, immersed in aniline hydrochloride, an aldehyde-blocking reagent, and Feulgen-processed. Whole periblast nuclei of comparable size were visible in periblast dissected off the yolk after fixation in Bouin's picro-formal and staining in Conklin's hematoxylin. The number of periblast nuclei in a 95-hour embryo was estimated to fall between 1,500 and 2,000. Generally, in regions near the axial embryo, periblast nuclei were large and not crowded; in regions more distant,

periblast nuclei were smaller and often more crowded. Small nuclei were round; medium-size nuclei were round, oblong, or reniform; large nuclei were reniform, very elongate, or lobulated. (Auth.)

8523. Schiffman, R.H. (Brain Res. Inst., Univ. of California, Los Angeles). 1965. STRONTIUM-CALCIUM TRANSPORT ACROSS THE GILL OF RAINBOW TROUT, (Salmo gairdnerii). J. Cell Comp. Physiol. 65(1): 1-6. Illus.; Biological Abstracts, 47(5): Abst. No. 20395. 1966.

This study was performed using radioactive isotopes of calcium and strontium as tracers in a perfused gill preparation. There were 2 levels in the uptake rates for strontium and calcium: a passive rate of 0.5×10^{-7} cm/sec, and 1.8×10^{-7} cm/sec, respectively, and a tenfold higher energy dependent rate of 5.1×10^{-7} cm/sec for strontium and 17×10^{-7} cm/sec for calcium. There was no evidence of discriminatory interaction between calcium and strontium at the passive levels of transport. Strontium was found to substitute for calcium at the active transport levels only if the calcium concentration of the environmental water was below approximately 0.1 mm Ca++/l. The rate of calcium and strontium loss from the gill was estimated as about 20 times faster than the influx rates. This caused the postulation that the net transfer of calcium ions across the gill could change, dependent upon the degree of saturation of the calcium-binding sites within the fish. (Auth.)

8524. David, P.M. (Natl. Inst. Oceanography, Wormley, Surrey, England). 1965. THE NEUSTON NET. A DEVICE FOR SAMPLING THE SURFACE FAUNA OF THE OCEAN. Jour. Mar. Biol. Assoc. U.K. 45(2): 313-320. Illus.; Biological Abstracts, 47(5): Abst. No. 20602. 1966.

A new form of net for sampling the fauna of the uppermost four inches of the ocean is described. The net is fished abeam of the towing vessel at a speed of about five knots. (Auth.)

8525. Hirayama, Kazutsugu, and Motoaki Shiomi (Suma Aquarium, Kobe, Hyogo, Japan). 1962. ON THE COUNTERMEASURE AGAINST DISEASE IN MARINE FISHES AT THE SUMA AQUARIUM OF KOBE CITY. Bull. Mar. Biol. Sta. Asamushi 11(2): 91-98; Biological Abstracts, 47(5): Abst. No. 20655. 1966.

Measures for the control of white spot disease of marine fishes (caused by the ciliate protozoan Ichthyophthirius marinus) are described and their effectiveness discussed. For prevention, water conditions (temperature, pH, chlorinity, dissolved oxygen, and cleanliness levels) are carefully maintained; its spread is limited by filtration, disinfection of tools, and isolation of new and certain susceptible fishes. Treatment begins as soon as the disease is detected, is conducted at night, and consists of Quininae Hydrochloridum 40-60 g/m^3 dissolved in water. --H. W. Wells.

8526. Walker, Charles R. (Bur. Sport Fisheries and Wildlife, La Crosse, Wis.). 1965. DIURON, FENURON, MONURON, NEBURON, AND TCA MIXTURES AS AQUATIC HERBICIDES IN FISH HABITATS. Weeds 13(4): 297-301.

The substituted urea herbicides were rated according to their effectiveness as aquatic herbicides in this order: diuron [3-(3, 4-dichlorophenyl)-1, 1-dimethylurea], neburon [1-butyl-3-(3, 4-dichlorophenyl)-1-methylurea], and TCA (trichloroacetic acid) mixtures with them. They showed greatest potential in controlling certain aquatic plants in preemergence and early postemergence applications. However, relatively high concentrations were required to control filamentous algae (Cladophora, Pithophora, and Spirogyra), chara (Chara), coontail (Ceratophyllum), naiad (Najas), and pondweeds (Potamogeton) for periods of time exceeding three months and up to three years. Granular formulations achieved better distribution of herbicides for control of rooted aquatic plants along the margins of lakes and ponds. Wettable powder and liquid emulsifiable concentrates were superior to granular formulations for the control of algae and emergent or floating aquatic plants. Monuron and fenuron were less toxic to fish than were diuron and neburon. The TCA mixtures were somewhat more toxic than the simple ureas. Some species

of fish were more sensitive than others and fingerlings more sensitive than adults of the same species. Fish-food organisms were reduced appreciably in plastic enclosures at herbicidal concentrations. (Auth.)

8527. Luk'yanenko, V.I. 1965. NATURAL ANTIBODIES IN FISH. Zool. Zh. 44(2): 300-304. (Engl. summ.); Biological Abstracts, 47(5): Abst. No. 23138. 1966.

The serum of normal fishes (10 species) contains natural agglutinins with respect to all 3 strains of bacteria pathogenic to fishes: Aeromonas punctata ("KV" strain and "VN" strains) and Pseudomonas fluorescens (strain "33"). The sera of different fish species considerably differ in both the frequency of their occurrence and in the titer value. (Auth.)

8528. Walker, Roland, and Ken Wolf (Rensselaer Polytech. Inst., Troy, N.Y.). 1962. VIRUS ARRAY IN LYMPHOCYSTIS CELLS OF SUNFISH. In: 59th Annual meeting of the American Society of Zoologists, Philadelphia, 1962. Amer. Zool. 2(4): 566. Abstract only; Biological Abstracts, 47(5): Abst. No. 23336. 1966.

8529. Chapman, Douglas G. (Dept. Math., Univ. of Washington, Seattle). 1965. THE ESTIMATION OF MORTALITY AND RECRUITMENT FROM A SINGLE-TAGGING EXPERIMENT. Biometrics 21(3): 529-542; Biological Abstracts, 47(6): Abst. No. 25296. 1966.

It is the aim of this paper to analyze data with no assumptions as to the nature of the recruitment. Where effort data is available, estimates for all parameters are found and an application of this made to a halibut tagging experiment. For the case that no effort data is available, simple regression curves are fitted to a series of raw population estimates. These yield an initial population estimate free of any assumptions together with some limited information on the recruitment and mortality processes. The method is applied to data of Parker from recapture of tags on a population of lake fish over approximately 2 months. (From Auth. Summ.)

8530. Kassner, Jerzy (Zool. Inst., Wrocaw Univ., Breslau, Poland). 1963. STUDIES ON THE MORPHOGENESIS OF SCALES IN THE RAINBOW TROUT (Salmo irideus Gibb.). Zool Pol 13(3/4): 153-162. Illus. (Polish and Russian summary); Biological Abstracts, 47(6): Abst. No. 25574. 1966.

A study was carried out on young individuals, about 3.5 cm in length 2 months after a mass hatching. The first scleroblastic papillae of the I period appear along the lateral line of the central body region, then the formation of the papillar rudiments proceeds anteriorly and posteriorly toward the cephalic and caudal regions, always following the lateral body line (II period). The last to appear are the papillae located radially from the first site of their formation (III period). The earliest rudiments become transformed into young scales. They gradually cover a fusiform area on both sides of the body. Scales of the anterior body region, on the dorsal and ventral sides of the body are the last to be formed. The results obtained from the observation provide some indication as to the age of the young Salmo individuals. --Courtesy NSF (PL 83-480) 1965.

8531. Mathur, Daya Swarup (Birla College, Pilani, Rajasthan, India). 1963. OBSERVATION ON THE TOXICITY OF DIELDRIN AND LINDANE TO CERTAIN FISHES. Zool Pol 13(1/2): 99-108. (Polish and Russian summary); Biological Abstracts, 47(6): Abst. No. 25576. 1966.

The insecticides Dieldrin and Lindane in low concentrations were found to produce little effect upon fishes, Dieldrin being less toxic than Lindane. Used in higher concentrations the insecticides caused excitability, convulsive movements, difficulty in respiration. Subsequently a quiescent period followed and finally death. Differences were observed in individuals and spp. --Courtesy NSF (PL 83-480) 1965.

8532. Orska, Janina (Zool. Inst., Wroclaw Univ., Breslau, Poland). 1963. THE INFLUENCE OF TEMPERATURE ON THE DEVELOPMENT OF MERISTIC

CHARACTERS OF THE SKELETON IN SALMONIDAE. II. VARIATIONS IN DORSAL AND ANAL FIN RAY COUNT CORRELATED WITH TEMPERATURE DURING DEVELOPMENT OF Salmo irideus Gibb. Zool Pol 13(1/2): 49-76. Illus. (Polish and Russian summary); Biological Abstracts, 47(6): Abst. No. 28237. 1966.

The alteration of the number of rays in 2 unpaired fins of Salmo irideus was studied after temperature changes of short duration were applied at the stages of gastrulation and body segmentation. Two phenocritical periods were ascertained for the dorsal fin rays: 1. at the stage of formation of the middle and posterior thoracic segments a reduction of the number of rays is induced by raising the temperature, whereas their number increases after cooling. 2. at the stage of development of caudal (I) segments warming as well as intensive cooling brings about a slight increase of the number of rays. The reaction of basalia is similar to that just described. Two periods of sensitivity were also ascertained for the anal fins: the first coincides with closure of the blastopore and of the formation of the caudal bud. Then the number of rays diminishes after heating and after cooling. The second phenocritical period follows the completion of segmentation. The effect of cold and heat is the same as in the first period. The basal rays react by a slight increase in number. --Courtesy NSF (PL 83-480) 1965.

8533. Arendarenko, G. A. 1964. CHAR AS AN OBJECT OF FISH CULTURE. In: Karelian fisheries. Petrozavodsk. 8. 141-143. From: Ref Zh Biol, 1965, No. 2I89. (Translation); Biological Abstracts, 47(8): Abst. No. 35605. 1966.

It has been established that the methods of artificial rearing of salmon are suitable in large measure for char. The best results are obtained by fertilizing the eggs with a mixture of spermatozoa from several males. Char eggs were found to be more sensitive to transfer than those of salmon. The initial experiments on the rearing of char in ponds gave good results. During the draining of the ponds, fingerling char weighed 3.1 g and were 6.8 cm long. The commercial value of char is noted, together with the feasibility of its introduction into new bodies of water.

8534. Remorov, V. A. (Dept. Hum. Anim. Physiol., V. V. Kuibyshev State Univ., Tomsk, USSR). 1965. MOTOR FUNCTION IN THE STOMACH OF THE PIKE (Esox lucius L.) AND THE INFLUENCE ON IT OF TRANSECTION OF THE VAGUS NERVES. Fiziol Zh SSSR IM I M Sechenova 51(5): 613-620. Illus.; Biological Abstracts, 47(8): Abst. No. 36220. 1966.

The motor activity of the stomach was recorded by the balloon method with water-air transmission. In the pike there are "hunger" movements of the stomach in the form of regular tonic contractions. The movements of the stomach in the pike arise shortly after it has ceased to be fed and continue almost without interruptions for a long time -- up to 40-70 hours. Most often, each contraction lasts about 3 minutes after which a pause follows, equal to 5-7 minutes. Inflation of the balloon terminates the movements of the stomach, but they again appear after 10-15 minutes. Transection of the vagus nerves leads to a fall in the tonus of the stomach and terminates its movements. However, even from the 2nd day on, the tonus begins to be reestablished and on the 4th-5th day, weak contractions also appear. --D. Franklin.

8535. Chervinski, J. (Fish Cult. Res. Sta., Dor, Israel). 1965. SEXUAL DIMORPHISM IN TILAPIA. Nature 208(5011): 703. Illus.; Biological Abstracts, 47(8): Abst. No. 36679. 1966.

While working with Tilapia aurea and T. galilaea it was noticed that sexing can be accomplished either according to the genital papilla, or according to the shape of the dorsal and anal fin. In males above 60 g the dorsal and anal fins are pointed, while in the females the dorsal and anal fins are rounded and more expanded. In bigger fish these differences are more distinct. These secondary sexual characteristics may be helpful in sexing Tilapia aurea and Tilapia galilaea.

8536. Avault, James W. Jr., and Ray Allison (Auburn Univ., Agr. Exp. Sta., Auburn, Alabama). 1965. EXPERIMENTAL BIOLOGICAL CONTROL OF A

TREMATODE PARASITE OF BLUEGILL. Exp. Parasitol. 17(3): 296-301; Biological Abstracts, 47(8): Abst. No. 39630. 1966.

An investigation was begun July 1, 1962, to determine the potential of snails infected with cercariae of Posthodiplostomum minimum to produce infection in bluegills, Lepomis macrochirus. Comparison of treatment means revealed that the intensity of infection was related more to size of the fish than to the number of infected snails to which the bluegills were exposed. An investigation was begun October 10, 1962, to determine the effectiveness of the redear sunfish, Lepomis microlophus, in reducing infection of P. minimum in bluegills through destruction of the snail host by the redear. Infected snails were released in pools at rates of 1, 5, or 10 per pool. Parasite-free snails were also stocked in all of the pools so that each pool contained a combined total of 100 snails. Bluegills were stocked in all of the pools. Some pools were stocked with redear, whereas others received no redear and were held as controls. Half of the pools stocked with redear contained vegetation. All bluegills were exposed to cercariae for 37 days at which time the exposure part of the experiment was terminated. One month later counts were made of the parasites found in each fish. When stocked alone with 1, 5, or 10 infected snails, bluegills averaged 48, 83, and 114 parasites per fish, respectively. In pools stocked with redear, bluegills contained an average of 16, 16, and 48 parasites per fish. In the presence of redear and vegetation, bluegills contained an average of 7, 9, and 32 parasites. Comparison of treatment means revealed that the redear was effective in significantly reducing infection of P. minimum in bluegills, and that the presence of aquatic vegetation did not reduce effectiveness of the redear. (Authors)

8537. Butskaya, N. A. (Dept. Anat. Histol., A. A. Zhdanov Leningr. State Univ., Leningrad, USSR). 1965. CYTOCHEMICAL STUDY OF FISH (Esox, Rutilus, Cyprinus, Perca, Acera) TESTES. I. NUCLEIC ACIDS, PROTEINS, AND POLYSACCHARIDES. Arkh Anat Gistol Embriol 48(4): 17-23. Illus. (English summ.); Biological Abstracts, 47(9): Abst. No. 40216. 1966.

Testes of different fishes (Esox lucius, Rutilus rutilus, Cyprinus carpio, Perca fluviatilus, Acerina cernua, and others) were used as an object of investigation. Primary spermatogonia, which are the largest cells in testes, have pale vesicular nuclei poor in DNA. The amount of DNA per unit of nuclear volume is relatively increased with a decrease in size of the cells during division in the spermatogonia. Microscopically DNA is homogenously distributed in the heads of the spermatozoa. In mature spermatozoa of perch and ruff, histones are replaced by protamines. In carps and roach the heads of mature spermatozoa contain histones. In pike they apparently contain proteins of different kinds. RNA was found in the cytoplasm and nucleoli of primary spermatogonia in all objects under study.

The amount of RNA in dividing spermatogonia doubles, a fact apparently connected with the growth of spermatogonia during the intervals between divisions (growth of cyst). In perciformes RNA may be found until spermatids appear. In cypriniformes it disappears in the spermatocytes which have ceased to grow. Paranuclear cytoplasmic corpuscles in spermatogonia are formations of a protein nature. (Auth.)

8538. Friend, Albert G., Albert H. Story, Corswell R. Henderson, and Kenneth A. Busch (Public Health Service, Div. Radiol. Health, Washington, D. C.). 1965. BEHAVIOR OF CERTAIN RADIONUCLIDES RELEASED INTO FRESH-WATER ENVIRONMENTS. ANNUAL REPORT 1956-1960. U.S. Public Health Service Publication 999-RH-13. 1-90. Illus. Maps; Biological Abstracts, 47(9): Abst. No. 40451. 1966.

Radionuclides from various sources, including facilities that produce, process, and handle nuclear material, are entering the fresh-water environment. The Service's Division of Radiological Health, in cooperation with the Atomic Energy Commission, has conducted a number of investigations of streams below atomic energy installations. Two such studies, one on the Mohawk River near Knolls Atomic Power Laboratory, and the other on the Clinch and Tennessee Rivers near

the Oak Ridge National Laboratory, are presented in this document. In general, the results show that all segments of the aquatic environment related to these rivers contain measurable quantities of manmade radionuclides. The results of some uptake studies, carried out in a DRH laboratory, are included to supplement the river studies and to aid in interpreting the results obtained in the field. (Authors)

8539. Heiligenberg, Walter (Max Planck Inst. Verhaltenphysiol., Starnberg, West Germany). 1965. THE EFFECT OF EXTERNAL STIMULI ON THE ATTACK READINESS OF A CICHLID FISH. Z Vergleichende Physiol 49(5): 459-464. Illus. (German summ.); Biological Abstracts, 47(9): Abst. No. 40611. 1966.

The readiness of a cichlid fish to attack conspecifics, measured by the number of attacks it delivers per minute in a standardized situation, can immediately be increased by presenting another fish or a dummy of a fish for a short time. After that, the attack readiness returns exponentially to its previous level. The analysis of the immediate increase in the attack readiness has shown that the appearance of a dummy causes an additive increase in attack readiness, which is raised by a constant amount after the dummy presentation. (Auth.)

8540. Protasov, V.R., V.I. Tsvetkov, and V.K. Rashceheperin (A.A. Severtsov Inst. Anim. Morphol., Acad. Sci. USSR, Moscow). 1965. ACOUSTIC SIGNALS EMITTED BY Neogobius melanostomus. Zh Obshch Biol 26(2): 151-160. Illus. (English summ.); Biological Abstracts, 47(9): Abst. No. 40628. 1966.

Sight and hearing play an important role in the behavior of Azov Neogobius melanostomus Pallas. Acoustic signals are emitted in the frequency range of 50 cps to 5 kcps. They are related to the benthic mode of life of fish and progeny protection. Sexual and age differences have been discovered in sounds emitted by the fish. Males emit 2 kinds of acoustic signals: threatening sounds and sounds attracting females. Sounds of threat resemble roaring. Their maximum acoustic energy falls on 200 cps and their duration reaches 1 sec. The fish use the sounds in combination with a threatening posture to drive rivals and enemies away from nests. Spawning sounds emitted by the fish are diverse in character, differ in duration and sound like weak croaking (with the duration of 1 sec.) and squealing (with the duration of 2.6 sec.). They consist of pulses with the maximum acoustic energy falling on 2 kcps. These sounds and their rough imitation are capable of attracting females. (Authors)

8541. Reid, George K. (Florida Presbyterian College, St. Petersburg, Florida). 1964. OXYGEN DEPLETION IN FLORIDA LAKE. Quart. Jour. Florida Acad. Sci., 27(2): 120-126; Biological Abstracts, 47(9): Abst. No. 40759. 1966.

During January 1962, Lake Maggiore in St. Petersburg, Florida, suffered an oxygen depletion accompanied by mass mortality of fishes. Measurements of dissolved O_2, carbon dioxide and air and water temperatures were made over a period of nearly 3 weeks following the catastrophe. Dissolved O_2 remained less than 20% of saturation until the 11th day; free carbon dioxide exceeded 6 ppm for a period of 2 weeks. Possible causes for the depletion relate to the production of growth inhibiting substances by algae and to sunlight and temperature fluctuations. (Auth.)

8542. LeGuen, J.C., F. Poinsard, and J. P. Troadec. 1965. THE YELLOWFIN TUNA (Thunnus albacares) FISHERY IN THE EASTERN TROPICAL ATLANTIC. Commercial Fisheries Review 27(8): 7-18. Illus. Maps; Biological Abstracts 47(9): Abst. No. 40774. 1966.

This study presents the results of an investigation carried out on the live-bait tuna clippers which landed their catches at Point Noire (Congo-Brazzaville) in 1964. Two-thirds of the trips were analyzed. The analysis allows us to describe the characteristics of the live-bait fishery in the region: catch per unit of effort, yield, and the gross relationship between the distribution of the concentrations of yellowfin and the oceanographic structure of the surface. Eighty percent of the catches were made in waters of 24° to 25° C. (the frontal zone). This relationship makes

it possible to use knowledge of the oceanography of the surface, and its seasonal variations, in scouting for fish. (Authors)

8543. Smith, L. L. Jr., R. H. Kramer, and J. C. MacLeod (Univ. of Minnesota, St. Paul). 1965. EFFECTS OF PULPWOOD FIBERS ON FATHEAD MINNOWS AND WALLEYE FINGERLINGS. Jour. Water Pollut. Control Federation 37(1): 130-140; Biological Abstracts, 47(9): Abst. No. 40781. 1966.

The effects of wood fibers on fish mortality were studied using fathead minnows and walleye pike fingerlings. These effects were dependent on fish species, fiber type, dissolved O_2 and temperature. Sublethal effects were also noted, particularly increased hematocrit and serum protein content. Using minnows, significant mortalities did not occur below 272 ppm groundwood, or below 738 ppm kraft or sulfite pulp. Using walleye fingerlings, mortalities occurred at 74 ppm of groundwood or sulfite pulp. --I. Gellman.

8544. Schwassman, Horst O., and Lawrence Kruger (Center Health Service, Univ. of California, Los Angeles). 1965. ORGANIZATION OF THE VISUAL PROJECTION UPON THE OPTIC TECTUM (MESENCEPHALON, BRAIN) OF SOME FRESHWATER FISH. Jour. Comp. Neurol. 124(1): 113-126. Illus.; Biological Abstracts, 47(9): Abst. No. 42572. 1966.

In 4 species of freshwater fish, bass, carp, bluegill and goldfish, the topographical relations of the visual field with the contralateral optic tectum were investigated, using a small light as stimulus in the visual field and recording the electrical response of the tectum with a metal microelectrode. The results show a precisely organized visual projection onto the contralateral tectum in which the anterior visual field lies anteriorly on the tectum, the temporal field posteriorly, the dorsal field medio-dorsally, and the ventral field in the latero-ventral part of the tectum. The projection was found to be essentially linear and uniform with no indication of a specialized area in the visual field in those species investigated. Some receptive fields extended into the anterior binocular visual field. (Auth.)

8545. Larson, Edward, and Luis R. Rivas (Univ. Miami, Coral Gables, Florida). 1965. CIGUATERA POISONING FROM BARRACUDA. Quart. Jour. Florida Acad. Sci. 28(2): 173-184; Biological Abstracts, 47(9): Abst. No. 42987. 1966.

From a 1 kg specimen of the flesh of a barracuda which had poisoned 5 persons, the following procedures were performed. Aqueous extracts prepared by the Halstead method were not toxic when injected (ip) into mice or young chickens. Intravenous injections into cats and application to the exposed turtle heart were without effect. The brei preparations were toxic when fed to cats or frogs, but were non-toxic to young chickens. In the cats, vomiting and diarrhea was produced. In 1 cat, skeletal muscular paralysis was induced for several days and 1 of the other 12 cats died. In the frogs, death was induced by gradual depression of the respiratory and cardiovascular systems; respiratory inhibition occurring first. From experiments in which the sciatic nerve was stimulated with Faradic current, it seems that the cause of the depression was central and not peripheral. (Authors)

8546. Sarig, S., M. Lahav, and M. Shilo (Div. Fisheries Res. Fish Diseases, Jerusalem, Israel). 1965. CONTROL OF Dactylogyrus vastator ON CARP FINGERLINGS WITH DIPTEREX. Bamidgeh 17(2): 47-52; Biological Abstracts, 47(9): Abst. No. 44073. 1966.

Treatment with 0.8 ppm of Dipterex (O, O-dimethyl-2, 2, 2-trichloro-1-hydroxyethyl-phosphate) destroys all 4 dactylogyrid species (Trematoda, Monogenea) in Israel, including D. vastator which causes severe losses of fingerling carp in spawning ponds. This concentration is not deleterious to carp fingerlings. Prophylactic treatment with 2 sprays of 0.8% Dipterex during the season (the first a week after the eggs hatch and the second 3 weeks thereafter) insures against fingerling mortality under normal breeding conditions. While 0.8% of Dipterex is not deleterious to rotifers and cyclops, it affects the chironomid larvae of the upper bottom layer. Full recovery of the chironomid population follows, however, after 6 days. (Auth.)

8547. Kamenskii, I. V. 1964. DIPLOSTOMATOSIS IN TROUT FOUND AT THE SHODNYA FISH FARM. Tr Vses Inst Gelmintol 11: 194-198. From: Ref Zh Biol, 1965, No. 16K37 (Translation); Biological Abstracts, 47(9): Abst. No. 44643. 1966.

Studies conducted at the Shodnya fish farm in Moscow Oblast from February to November 1961 showed that diplostomatosis is widespread in trout in all the ponds and in the troughs of the incubation areas. Of the 153 trout specimens studied 133 (86.9%) had diplostomatosis. The degree of infestation of the trout increases as the fish ages. In 14-day-old fingerlings the extent of invasion reaches 40%; in 30-day-old fingerlings it reaches 75%; and in 60-day-old ones it reaches 100%. The rate of infestation is from 8 to 42 specimens. The maximum rate of invasion takes place in June and July. The degree of infestation with diplostomatosis of the contaminated fish is given. The molluscs Limnaea stagnalis and Radix ovata are intermediate hosts, while the blackhead gull (Larus ridibundus) is the definitive host. Means of controlling diplostomatosis are given. There is a bibliography with 13 references. (Auth.)

8548. Anderson, William D. Jr. (U.S. Bur. Comm. Fish. Biol. Lab., Brunswick, Georgia). 1964. FISHES OF SOME SOUTH CAROLINA COASTAL PLAIN STREAMS. Quart. Jour. Florida Acad. Sci., 27(1): 31-54; Biological Abstracts, 47(9): Abst. No. 44920. 1966.

A study of the distribution of the freshwater fishes in the Ashepoo, Combahee, Broad, and New River drainages of southeastern South Carolina revealed the presence of 53 spp. representing 31 genera, 17 families, and 9 orders. Twenty-five of the spp. collected had never been reported from the area and many others had not been recorded from one or more of the drainages. All freshwater fish reported in the literature for this area were collected in at least one of the drainages studied. (Auth.)

8549. Murphy, Glenn W. (College Education, Univ. of Kentucky, Lexington). 1964. FISHES OF THE GREEN RIVER BASIN IN CASEY AND LINCOLN COUNTIES, KENTUCKY. Trans. Kentucky Acad. Sci., 25(1/2): 65-73; Biological Abstracts, 47(9): Abst. No. 44930. 1966.

When the results of a study of the distribution of fishes in the Upper Green River Basin, draining about 450 square miles, were combined with those of studies by the Kentucky Department of Fish and Wildlife Resources it was found that 11 families of fishes, including 69 spp., had been observed. As the stream order (Horton's system) increased, the number and diversity of spp. increases. --R. H. Weaver.

8550. Squire, James L., Jr. (U.S. Bur. Sport Fisheries and Wildlife, Tiburon Marine Lab., Tiburon, Calif.). 1964. ATLAS OF EASTERN PACIFIC MARINE GAME FISHING. U.S. Fish and Wildlife Service Circular 174 (Revised). 8 p. 21 charts.

A series of 21 charts outline the areas where there is significant sport fishing, the species of fish taken, and the seasons at which they are most available. References are made to facilities like charter or party boats, rental skiffs, and launching ramps or lifts, and to some coastal streams where species like steelhead, sea-run cutthroat trout, and salmon may be taken. Material for annotation of the charts has been compiled from the references listed in the bibliography, from personal observation, and from the many helpful individuals who provided information or checked the charts and text for accuracy.

8551. Pongsuwana, Umpol. (Dept. Fish., Bangkok, Thailand). 1962. PROGRESS OF RICEFIELD FISH CULTURE IN THAILAND. In: Proc. of the 10th Session of the Indo-Pacific Fisheries Council, Seoul, Korea, 10-25 October, 1962. Indo-Pacific Fish. Council Proc. 10(Sect. 2): 157-163; Biological Abstracts, 46(16): Abst. No. 69389. 1965.

The development of fish culture in rice fields in Thailand is reviewed and the results of experiments carried out in the Central and Northern Regions of Thailand with single species as well as with mixed species are described. (Auth.)

8552. Schmidt, P.J., B.S. Mitchell, and H. Tsuyuki (Fish. Res. Board Canada, Technol. Res. Lab., Vancouver, B.C., Canada). 1965. PITUITARY HORMONES OF THE PACIFIC SALMON. 1. RESPONSE OF GONADS IN IMMATURE TROUT (Salmo gairdnerii) TO EXTRACTS OF PITUITARY GLANDS FROM ADULT PACIFIC SALMON (Oncorhynchus). Gen Comp Endocrinol 5(2): 197-206. Illus.; Biological Abstracts, 46(16): Abst. No. 69389. 1965.

The development of gonads in intact immature male Salmo gairdnerii is stimulated by extracts of pituitary glands from adult Pacific salmon so that under defined conditions the increase in tests weight is proportional to the dose. The gonads of immature female S. gairdnerii are stimulated to a lesser degree by the same extracts. (Authors)

8553. Fowler, Laurie G., and Edward M. Wood (Bur. Sport Fisheries and Wildlife, Salmon-Cultural Lab., Longview, Washington). 1966. EFFECT OF TYPE OF SUPPLEMENTAL DIETARY FAT ON CHINOOK SALMON FINGERLINGS. Progressive Fish-Culturist, 28(3): 123-127.

Hard animal fat fed as the principal lipid source to fall chinook salmon fingerlings (Oncorhynchus tshawytscha) produced significant accumulations of lipoproteins within the hepatic cells and degenerative changes of the spleen and hematopoietic portion of the kidney. The substitution of peanut oil for hard fat produced fish with none of these abnormalities. (Authors)

8554. Cairns, John Jr., and Arthur Scheier (Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.). 1966. THE INFLUENCE OF EXPOSURE TO ABS DETERGENT UPON THE BLOOD CHLORIDE REGULATION OF THE PUMPKINSEED. Progressive Fish-Culturist, 28(3): 128-132.

Adult pumpkinseed, Lepomis gibbosus (L.), were exposed to an 18-ppm mixture of alkyl benzene sulfonate of which 54.8 percent was active ingredient. The customary striking gill damage resulted, and the influence of this damage upon the chloride content of the blood was determined while the fish were maintained for 42 days in a synthetic dilution water at 60 ppm Cl. Chloride regulation was checked by exposing a second group of fish to 60 ppm Cl for 21 days and then abruptly increasing the Cl concentration of the water to 6,500 ppm and holding it at that concentration for 21 days. Neither group of fish exposed to ABS had blood chloride concentrations significantly different from those of the controls. (Authors)

8555. Sakuda, Henry M. (Dept. of Land and Natural Resources, Honolulu, Hawaii). 1966. A MODIFIED PLASTIC INTERNAL ANCHOR TAG. Progressive Fish-Culturist, 28(3): 132.

A three-layered plastic plate with a center hole that can take a polypropylene monofilament is used to tag Trachurops crumenophthalmus in Hawaii.

8556. Sorenson, Leroy, Keen Buss, and Arthur D. Bradford (Union City Hatchery, Pennsylvania Fish Comm., Union City, Pa.). 1966. THE ARTIFICIAL PROPAGATION OF ESOCID FISHES IN PENNSYLVANIA. Progressive Fish-Culturist, 28(3): 133-141.

New techniques are described to improve the egg viability and egg incubation of the Esocidae, notably the muskellunge (Esox masquinongy) and the northern pike (E. lucius). The viability of eggs was increased, in general, from 15% to better than 85%. Also described is a method of intensive culture of esocids in hatchery tanks which will produce a predictable number of fall fingerlings. Other aspects related to the artificial propagation of the pikes are discussed, including transportation in plastic bags. (Authors)

8557. Berquist, Howard, and Jack Mason (Wisconsin Conservation Dept., St. Croix Falls, Wis.). 1966. AUTOMATIC FEED DISPENSERS. Progressive Fish-Culturist, 28(3): 141.

Used in hatcheries, the feeders have shown possibilities for more efficient indoor propagation.

8558. Giudice, John J. (Bur. Sport Fisheries and Wildlife, Fish Farming Exp. Station, Stuttgart, Ark.). 1966. GROWTH OF A BLUE X CHANNEL CATFISH HYBRID AS COMPARED TO ITS PARENT SPECIES. Progressive Fish-Culturist, 28(3): 142-145.

Yearling (age-group I) blue x channel catfish hybrids stocked at a rate of 500 fish per acre in a pond with equal numbers of the parent species showed a weight increase 11% greater than the channel catfish and 32% greater than the blue catfish after the first full growing season (April through October). At a rate of 14 fish of each group per acre, the hybrids gained 23% more than the channel catfish, where these catfishes were stocked with buffalo fingerlings at a rate of 1,000 per acre. Growth of the hybrid was not compared with that of the blue catfish because of insufficient data. Measurements during August in the second growing season indicated that these differences were even greater. The hybrids showed a weight increment 41% greater than the channel catfish and 32% greater than the blue catfish. Visual examinations of age-group II hybrids indicated that only slight gonadal development had occurred in both sexes. No conclusion was possible concerning the potential fertility of either sex. (Auth.)

8559. Klein, W. D. (Colorado Dept. Game, Fish and Parks, Ft. Collins, Colo.). 1966. THE SUMMER MOVEMENT OF HYBRID AND BROOK TROUT INTO AN INLET STREAM. Progressive Fish-Culturist, 28(3): 146-151.

Hybrid trout (Salvelinus fontinalis x S. namaycush) and brook trout (Salvelinus fontinalis) were recovered in a trap in the inlet of Parvin Lake during the summer of 1962. A run of hybrid trout started on June 19 and extended to July 14, with a peak of 30 fish on June 28. Brook trout first appeared in the upstream trap on June 24 and continued to run through July. Migration was closely associated with warm lake surface temperatures (60°-66° F.) and cool minimum stream temperatures (37°-55° F.). Thirty-two percent of the hybrid trout recovered in the trap, tagged, and released in the lake, re-entered the trap one or more times. Five of 25 trapped and tagged brook trout also re-entered the trap one or more times. A population estimate in May 1962 indicated that 10.7% of the hybrids and 24.7% of the brook trout present in the lake entered the inlet trap. (Auth.)

8560. Buss, Keen, and Kenneth G. Corl (Benner Spring Fish Research Station, Pennsylvania Fish Comm., Bellefonte, Pa.). 1966. THE VIABILITY OF TROUT GERM CELLS IMMERSED IN WATER. Progressive Fish-Culturist, 28(3): 152-153.

Both brook trout (Salvelinus fontinalis) and brown trout (Salmo trutta) eggs were capable of fertilization to some degree after a longer period of water immersion than previously reported. Some fertilization was possible after the eggs had been immersed in water for 20 minutes. The length of time sperm was viable after water immersion coincided with motility observed under a microscope. After 15 seconds viability declined. No activity was recorded after 2 minutes. (Authors)

8561. Clemens, Howard P., Suchit Bhinyoying, and Norman Youngstead (Univ. of Oklahoma, Dept. of Zoology, Norman, Okla.). 1966. AN EVALUATION OF DYLOX MEDICATION ON GROWTH AND REPRODUCTION OF THE GOLDFISH AND GUPPY. Progressive Fish-Culturist, 28(3): 159-161.

From feeding experiments with guppies (Lebistes reticulatus) and goldfish (Carassius auratus), it appears that 0.4% Dylox in the food does not appreciably hinder aspects of growth and reproduction. Fish on Dylox medication were observed to grow similarly to the control fish, to mature at the same rate, to have similar reproductive rates and capacities, and to have normal fertility and spawning behavior. (Authors)

8562. Anderson, James C. (Bur. Sport Fisheries and Wildlife, National Fish Hatchery, Edenton, N. C.). 1966. PRODUCTION OF STRIPED BASS FINGERLINGS. Progressive Fish-Culturist, 28(3): 162-164.

Demand for striped bass, Roccus saxatilis (Walbaum), to stock led to testing

methods of fingerlings production. Sac fry were fed emulsified shrimp. Advanced fry were fed on Daphnia pulex and rotifers after being stocked in an earthen pond. When the supply of daphnia and rotifers was depleted, ground herring and trout food were used as a production diet. Thirty thousand fingerlings weighing 300 pounds were produced. (Auth.)

8563. McCrimmon, Hugh R., and Alfred H. Berst (Univ. of Guelph, Guelph, Ontario, Canada). 1966. A WATER RECIRCULATION UNIT FOR USE IN FISHERY LABORATORIES. Progressive Fish-Culturist, 28(3): 165-170.

A small semiportable recirculation unit which incorporates filtration, aeration, and temperature control is described and evaluated.

8564. Mason, John C., and James L. Fessler (Oregon State Univ., State Game Comm., Corvallis, Oreg.). 1966. A SIMPLE APPARATUS FOR THE INCUBATION OF SALMONID EMBRYOS AT CONTROLLED LEVELS OF TEMPERATURE, WATER FLOW, AND DISSOLVED OXYGEN. Progressive Fish-Culturist, 28(3): 171-174.

Description of an incubating apparatus which allows production of fry material reflecting physiological stress induced by manipulation of water temperature, flow, and dissolved oxygen concentration. (Authors)

8565. Witty, Kenneth (Oregon State Game Comm., Enterprise, Oreg.). 1966. TRAVEL RATE OF DOWNSTREAM-MIGRANT COHO SALMON. Progressive Fish-Culturist, 28(3): 174.

The average rate of travel of downstream-migrant coho salmon from the Wallowa River to Bonneville Dam was 48.1 miles per day for a distance of 433.0 miles.

8566. Hunter, John R., Donald C. Aasted, and Charles T. Mitchell (U.S. Bureau of Commercial Fisheries, Tuna Resources Lab., La Jolla, Calif.). 1966. DESIGN AND USE OF A MINIATURE PURSE SEINE. Progressive Fish-Culturist, 28(3): 175-179.

A description, scale drawings, and list of materials are provided for the construction of a miniature purse seine which can be set from a small skiff. Procedures for setting the net are outlined. (Authors)

8567. Green, O. L. (Bur. Sport Fisheries and Wildlife, Marion, Ala.). 1966. OBSERVATIONS ON THE CULTURE OF THE BOWFIN. Progressive Fish-Culturist, 28(3): 179.

Five sexually mature bowfin (Amia calva), 2 males and 3 females, were placed with other species in a shallow 3.2-acre hatchery pond in February and March 1965. Drainage of the pond on April 22 revealed bowfin about 2 inches long. The pond was not refilled until May 12. When it was drained again on August 28, 24 bowfin were recovered.

8568. Ziebell, Charles D. (Washington State Pollution Control Comm., Olympia, Wash.). 1966. A FLOATING FIELD LABORATORY FOR ESTUARINE FISH TOXICITY STUDIES. Progressive Fish-Culturist, 28(3): 180-182.

To define the toxicity of industrial wastes to juvenile salmon under field conditions, a floating field laboratory was constructed. This was used successfully in estuaries receiving pulp and paper wastes. Details of construction are given, and the tests conducted are described. (Auth.)

8569. Narver, David W. (Univ. of Washington, Fisheries Research Institute, Seattle, Wash.). 1966. A PROTOTYPE KOKANEE SPAWNING CHANNEL. Progressive Fish-Culturist, 28(3): 183-184.

A 3-foot-wide artificial spawning channel for kokanee was established in 2 hatchery ponds and their creek outlet. The clay bottom was replaced to a depth of 1 foot with washed, 2-inch graded gravel. After water rediversion, water depth was 4 inches, velocity 0.7 fps, and flow 1.2 cfs. Use of the channel was apparently intensive in the first year. (Auth.)

8570. Isaacson, Peter A., and Robert M. Tyo (U.S. Public Health Service, Cincinnati, Ohio). 1966. ENDRIN SORPTION DATA FROM A SUSPENSION EXPOSED TO CLEAR PLASTIC TUBING. Progressive Fish-Culturist, 28(3): 184.

A suspension of Endrin in water, with Triton^{2}X100 as emulsifier, was pumped through a section of Tygon tubing. Solvents collected when the tubing had been cut in thirds and extracted showed that the Tygon tubing sorbed a significant amount of Endrin.

8571. Calhoun, Alex (Ed.). (California Dept. Fish and Game, Sacramento). 1966. INLAND FISHERIES MANAGEMENT. Available from Office of Procurement, Documents Section, P.O. Box 1612, Sacramento, Calif. 95807. Price $3.84. 546 p.

A handbook aimed primarily at the field men responsible for California's inland fisheries: the biologists, the men who operate the fish hatcheries, and the wardens. It gives them ready access to a large body of inland fisheries fact and theory. Incorporated in it is much recent management experience.

8572. Boles, Hallett D., and David P. Borgeson (Calif. Dept. Fish and Game, Sacramento, Calif.). 1966. EXPERIMENTAL BROWN TROUT MANAGEMENT IN LOWER SARDINE LAKE, CALIFORNIA. California Fish and Game 52(3): 166-172. Illus.

Seven years were spent studying various sizes and strains of planted brown and rainbow trout in this high elevation, oligotrophic lake. All fingerlings tested produced very low angling returns. Domesticated strains of catchable-sized browns equalled the best strains of domesticated rainbows in return to anglers. Both rainbows and browns produced better angling returns when stocked early in the season than when stocked late in the fall. All stocked trout grew slowly, and very few grew larger than 11 inches even after 4 or more years in the lake. (Authors)

8573. Johnson, W.C. (Calif. Dept. Fish and Game, Los Angeles, Calif.). 1966. TOXAPHENE TREATMENT OF BIG BEAR LAKE, CALIFORNIA. California Fish and Game 52(3): 173-179.

Big Bear Lake was treated in 1960 to eradicate an abundant population of goldfish, Carassius auratus, and an ectoparasitic copepod, Lernaea carassii. The treatment followed two unsuccessful rotenone applications. Some goldfish survived the toxaphene treatment but their numbers were drastically reduced. (Auth.)

8574. Utter, Fred M., George J. Ridgway, and James W. Warren (Bur. of Commercial Fisheries, Seattle, Wash.). 1966. SEROLOGICAL EVIDENCE FOR INBREEDING OF LAHONTAN CUTTHROAT TROUT, Salmo clarkii henshawi, IN SUMMIT LAKE, NEVADA. California Fish and Game 52(3): 180-184.

Tests with isoimmune sera of rainbow trout, Salmo gairdnerii, have demonstrated blood types in Lahontan cutthroat trout. The more uniform reactivity in cutthroat trout from Summit Lake than in those from Catnip Reservoir indicated a greater degree of genetic homogeneity that may have resulted from inbreeding in the Summit Lake population. Blood typing techniques are applicable to trout breeding and management practices. (Authors)

8575. Applegate, Shelton P. (Los Angeles County Museum, Los Angeles, Calif.). 1966. A POSSIBLE RECORD-SIZED BONITO SHARK, Isurus oxyrinchus Rafinesque, FROM SOUTHERN CALIFORNIA. California Fish and Game, 52(3): 204-207. Illus.

An 11-foot bonito shark, a size record for California and possibly for the world, was caught on July 4, 1965, in 3 fathoms of water off Santa Catalina Island. The shark was a female weighing 850 pounds. The stomach contained remains of three carcharinid sharks. --Anita Daugherty.

8576. Decker, Laurence F. 1965. STAIRWAYS FOR SPAWNERS. Maine Fish and Game, 7(1): 30-32. Illus.

A review of the progress of fishway construction in Maine. It describes and gives pictures of various types of fishways used in Maine and provides some data on costs.

8577. Rogers, Wilmer A. (Agricultural Experiment Sta., Auburn Univ., Auburn, Ala.). 1966. THREE NEW SPECIES OF Pseudomurraytrema (Trematoda: Monogenea) FROM GILLS OF CATOSTOMID FISHES. Jour. of Parasitology, 52(3): 462-465.

Three new species of Ancyrocephalinae, namely Pseudomurraytrema alabarrum sp. n., P. etowanum sp. n., and P. swinglei sp. n., are described from the gills of spotted sucker (Minytrema melanops Rafinesque), Alabama hog sucker (Hypentelium etowanum Jordan), and black redhorse (Moxostoma duguesnei LeSueur), respectively. A generic emendation is presented. Only one species has been reported in this genus previously. All fish hosts were collected in Lee County, Alabama. (Auth.)

8578. Hohn, Matthew H. (Dept. of Biology, Central Michigan Univ., Mt. Pleasant, Mich.). 1966. ANALYSIS OF PLANKTON INGESTED BY Stizostedium vitreum vitreum (Mitchill) FRY AND CONCURRENT VERTICAL PLANKTON TOWS FROM SOUTHWESTERN LAKE ERIE, MAY 1961 AND MAY 1962. Ohio Jour. Sci., 66(2): 193.

The analysis of plankton tows for May 1961 and May 1962 showed four species of diatoms, Melosira binderana, M. ambigua, Fragilaria capucina, and F. crotonensis to be dominant. The analysis of the intestinal tract of the walleye fry showed these four species to be dominant in the fry up to 9 mm. Those fry above 9 mm contained zooplankton as well as species of these diatoms. This preliminary study indicates a change in food habits of the walleye fry at the 9-mm stage. (Auth.)

8579. Olson, Robert E. (Dept. of Zoology and Entomology, Montana State Univ., Bozeman, Mont.). 1966. SOME EXPERIMENTAL FISH HOSTS OF THE STRIGEID TREMATODE Bolbophorus confusus AND EFFECTS OF TEMPERATURE ON THE CERCARIA AND METACERCARIA. Jour. of Parasitology, 52(2): 327-334.

Experimental studies were conducted on the digenetic trematode, Bolbophorus confusus (Krause, 1914) Dubois, 1935, to test host specificity in fish and the effect of temperature on the cercaria and metacercaria. Typical infections followed laboratory exposures of the following fishes: Salmo gairdneri, Salmo trutta, Salvelinus fontinalis, Prosopium williamsoni, Pimephales promelas, Hybopsis gracilis, Rhinichthys cataractae, Catostomus commersoni, Pantosteus platyrhynchus, Lepomis macrochirus, and Gambusi affinis. Cercarial penetration occurred in Ictalurus punctatus and Cottus bairdi, but metacercarial development was atypical. Maximum cercarial penetration of fish occurred between 66 and 85° F. Invasive ability was markedly reduced between 55 and 65° F. and very few penetrations occurred below 54° F. Metacercariae developed rapidly at 70° F. No metacercarial development was found in fish exposed to cercariae at 70° F. and then held at 40 to 42° F. Some metacercariae were observed to develop normally when fish treated in the above manner were returned to 70° F., after being held at 40 to 42° F for 1 month. Water temperature apparently plays a major role in the distribution of the metacercaria of B. confusus (common only in one lake) in southwestern Montana. (Auth.)

8580. Rupp, Robert S., and Malcolm A. Redmond (Maine Dept. Inland Fisheries and Game, Orono). 1966. TRANSFER STUDIES OF ECOLOGIC AND GENETIC VARIATION IN THE AMERICAN SMELT. Ecology, 47(2): 253-259.

Introductions of American smelts, Osmerus mordax, from six established populations into eight new environments were made in Maine in 1957-62 to determine which characteristics of the parent populations would be altered by transfer to the new environments and which would remain unaltered. Four of the host lakes had not contained smelts previously, three had contained smelts which

were removed by rotenone, and one is thought to have contained a smelt population which disappeared 4 or 5 years before the experimental transfer. In several cases the growth rates, lengths, and longevities attained by smelts changed greatly with change in their environment. The time of the spawning season for one stock of smelts remained unaltered following transfer to an environment where the previous smelt population routinely had spawned much later. In one case smelts hatched from eggs of a stream-spawning population adapted immediately to the shore-spawning habit in a host lake where tributaries are absent. The success of smelts in the various new environments appeared to depend mostly upon the intensity of interspecific competition and other biotic factors, as with most fishes. (Authors)

8581. Differ, William R., and Troy C. Dorris (Aquatic Biology Lab., Oklahoma State Univ., Stillwater). 1966. PRIMARY PRODUCTIVITY IN A SOUTHERN GREAT PLAINS STREAM. Limnology and Oceanography, 11(2): 143-151.

Physico-chemical conditions and community metabolism in a relatively undisturbed stream in Oklahoma were studied from June 1963 to August 1964. Stream reaches were selected in geological formations outcropping primarily as limestone, granite, and sand. Total alkalinity decreased and carbonate alkalinity increased downstream. Summer chlorophyll concentration was highest on the granite outcrop. High chlorophyll concentrations occurred in upstream reaches on large boulders in the channel bed, and low concentrations occurred downstream on shifting sand. Gross photosynthesis varied from 10.1 g O_2 m^{-2} day^{-1} in winter to 48.0 g O_2 m^{-2} day^{-1} in summer on the granite outcrop and always exceeded respiration. High primary productivity and respiration resulted from large populations of benthic algae and bryophytes growing on the granite formations. Community respiration always exceeded photosynthetic productivity at reaches in limestone and sand formations. Annual primary production varied from 1.1 kg/m^2 on the sand to 7.8 kg/m^2 on the granite. Daily photosynthetic efficiencies ranged from 0.1 to 2.7%. As solar radiation increased during the day, photosynthetic productivity increased, but efficiency of utilization of solar radiation decreased. (Authors)

8582. Schoffman, Robert J. (Griffin High School, Springfield, Illinois). 1966. AGE AND RATE OF GROWTH OF BLUEGILLS IN REELFOOT LAKE, TENNESSEE, FOR 1958 AND 1965. Jour. Tennessee Acad. Sci., 41(1): 32-34.

The study of age and growth of bluegills in Reelfoot Lake, Tennessee, has extended over a period of twenty-nine years and during this period a change in growth rate has slowly been taking place. The length of each age group has also slowly decreased since 1947 except for the present study which shows a notable increase in weight. Between each check from 1937 through 1958 changes in fishing regulations have been made. From 1958 to the present no changes in fishing regulations have been made for bluegills. Each check shows that more small fish are being caught which indicates an overpopulation of bluegills is being built up. The restriction of bluegill fishing to sport fishing is of no value unless there is a depletion of fish due to biological causes. Since there is no such depletion, the restriction is unnecessary.

8583. Putz, Robert E., and Glenn L. Hoffman (Bur. Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va.). 1966. Urocleidus flieri n. sp. (Trematoda:Monogenea) FROM THE FLIER SUNFISH. Helminthological Soc. of Washington, 33(1): 46-48.

Urocleidus flieri n. sp. from the flier sunfish, Centrarchus macropterus Lacepede, is described and compared with other Urocleidus species of North America. (Authors summ.)

8584. Hasler, Arthur D. 1966. UNDERWATER GUIDEPOSTS: HOMING OF SALMON. Univ. of Wisconsin Press, Madison. 167 pp. Illus. $6.

A summary of recent work on the hypotheses and experiments attempting to account for the homing migration of fishes, particularly salmon. The author relates the basis for his own theories concerning the use of odor for locating

parent streams. These ideas are detailed and an account is given of recent activities at the Limnological Laboratory of the University of Wisconsin, which attempt to explain the mechanism of the open water and marine phases of homing. The book is written in a style that the general public will find exciting and understandable, but the volume also provides sufficient data to serve colleagues working in other scientific disciplines as a general review of the problem. Investigators working in the field of fish migration will refer to the volume, not only because it is a succinct summary of Hasler's theories, but also for the account of the historical development of the reasoning behind his experiments. The book is organized for the general reader, almost half of it being devoted to the stream phase of salmon homing — for example, a discussion of the laboratory experiments and field tests of the various hypotheses. A shorter section discusses the open water and oceanic phases of salmon migration, phases that Hasler's group has only recently begun studying. The book closes with a summary of other or alternative types of mechanisms that could account for fish homing and, finally, a statement of Hasler's complete hypothesis.

8585. Kawatsu, Hiroshi. 1966. STUDIES ON THE ANEMIA OF FISH. 1. ANEMIA OF RAINBOW TROUT CAUSED BY STARVATION. Bull. of Freshwater Fisheries Research Lab, 15(2): 167-173.

Various changes on the characteristics of blood of rainbow trout fingerlings were observed after 12 weeks of starvation. The erythrocyte count and hemoglobin value increased in the early stage of starvation, but decreased thereafter so that the anemia appeared. The anemia caused by starvation was characteristic of microcytic erythrocytes and the disappearance of immature cells. (Auth. summ.)

8586. Toner, E. D. (Dept. of Lands, Fisheries Div., Dublin, Ireland). 1966. SYNOPSIS OF BIOLOGICAL DATA ON THE PIKE Esox lucius Linnaeus 1758. FAO Fisheries Synopsis No. 30, Rome, Italy.

8587. Cartier, John O. 1966. MIDSUMMER TROUT RUN — TROPHY BROWNS OF THE BRULE. Outdoor Life, 138(2): 40, 41, 96, 97, 100.

A lamprey-control weir showed the extent of the summer brown trout run out of Lake Superior into the Brule. The run lasts from mid July until late September being heaviest in August. The trout are hatched in the river and leave it for Lake Superior when 6 to 8 inches long. When they are about 4 years old and weigh nearly 5 pounds they return to spawn in the river. Five-year-old lake-run brown trout measure 22 or 23 inches and weigh from 5 to 7 pounds, much larger than the trout which remain in the river. Studies have shown that there are more browns making the summer run in the Brule than there are rainbows in the more publicized fall run.

8588. Bourbon, Ken. 1966. WILDLIFE NOBODY WANTS. Fish-Fur-Game, 62(2): 5-7.

An interesting account of some of the best and worst introductions of foreign fish, birds, and mammals in various parts of the world.

8589. Threinen, C. W., Clarence Wistrom, Bert Apelgren, and Howard Snow. 1966. THE NORTHERN PIKE — ITS LIFE HISTORY, ECOLOGY, AND MANAGEMENT. Wisconsin Conservation Dept. Publication No. 235. 16 p.

8590. Armstrong, Robert H., and Roger F. Blackett (Alaska Dept. Fish and Game, Juneau, Alaska). 1966. USE AND EVALUATION OF DART TAGS TO STUDY THE MIGRATION HABITS OF DOLLY VARDEN, Salvelinus malma (Walbaum). Trans. American Fisheries Society, 95(3): 320-323.

8591. Francois, Donald (New South Wales State Fisheries, Australia). 1965. CANADIAN ATLANTIC SALMON FOR NEW SOUTH WALES. The Atlantic Salmon Journal, Winter, 1965. pp. 22-24.

A shipment of 100,000 Atlantic salmon eggs was sent to Australia from Nova Scotia in an attempt to establish a land-locked Atlantic salmon fishery in New South Wales. In October 1963, about 9,000 young salmon were released into a tributary of the Goodradigbee River.

8592. Wetzel, Robert G. (Dept. of Zoology, Indiana Univ., Bloomington). 1965. NUTRITIONAL ASPECTS OF ALGAL PRODUCTIVITY IN MARL LAKES WITH PARTICULAR REFERENCE TO ENRICHMENT BIOASSAYS AND THEIR INTERPRETATION. Proceedings of the I. B. P. Symposium on Primary Productivity in Aquatic Environments, Pallanza, Italy, April 1965. Mem. Ist. Ital. Idrobiol., 18 Suppl.: 137-157.

A brief summary is presented of some of the results of investigations of the causal relationships between nutrient factors in alkaline, highly calcareous marl lakes and low levels of growth of algal populations. By application of carbon-14 growth factor enrichment bioassays on simultaneous cultures of natural phytoplankton populations of several lakes, analyses were made of the role of organic and inorganic nutrients influencing seasonal fluctuations of rates of production. The low levels of algal productivity and associated low quantities of dissolved organic matter in extremely calcareous marl lakes are interrelated in a circular causal system that perpetuates low rates of growth. This situation is compounded by physiological unavailability of several inorganic nutrients present in insoluble forms for a large portion of the year. The advantages and the problematic areas of the use of carbon-14 enrichment bioassays with natural populations of phytoplankton are emphasized. The sensitivity to growth responses, and the elimination of a lag in growth response, make the bioassay techniques ideal for the elucidation of the role of inorganic nutrients, as well as accessory organic growth factors, in regulation of population metabolism. The influence of minor elements is not always direct, and caution is necessary in interpretation of certain stimulatory responses. (Auth.)

8593. Wetzel, Robert G. (Dept. of Zoology, Indiana Univ., Bloomington). 1965. TECHNIQUES AND PROBLEMS OF PRIMARY PRODUCTIVITY MEASUREMENTS IN HIGHER AQUATIC PLANTS AND PERIPHYTON. Proceedings of the I. B. P. Symposium on Primary Productivity in Aquatic Environments, Pallanza, Italy, April 1965. Mem. Ist. Ital. Idrobiol., 18 Suppl.: 249-267.

A brief summary is presented of the techniques for measuring biomass and the in situ production rates of aquatic macrophytes and periphyton. Problems of interpretation, intercalibration of methods, and adaptations of techniques to various habitats are emphasized. Evidence indicates that the in situ oxygen light and dark chamber technique should not be used for estimates of production rates of vascular aquatic plants. Oxygen evolved during photosynthesis accumulates, is stored in the internal lacunae, and is utilized to various degrees during periods of darkness. As a result, dissolved oxygen of the surrounding water is not proportional to the production of oxygen and photosynthetic rates. The in situ C^{14} technique of determining production rates of macrophytes is discussed in view of recent findings that indicate diurnal variations in photosynthesis and the efficiency of light utilization. Major problems of estimating biomass of periphyton include the placement of substrata for colonization, heterogeneity of distribution, and the rate of population turnover. The advantages and problems of various in situ methods of measuring production rates of periphyton are considered. (Auth.)

8594. Anonymous. 1966. KEEPING TAHOE ALIVE. Time, 88(7): 46-47.

A 6 million gallon sewage disposal plant is planned for the Lake Tahoe area. The adequately filtered effluents will be carried over the mountains out of the lake basin to provide needed irrigation water. The cost will be about $4 million.

8595. Taylor, Zack. 1966. MUSKY ROUNDUP. Sports Afield, 156(1): 34, 35, 58.

Development of many new large impoundments in the eastern United States and the high populations of forage fish found in them have made practical the stocking of

muskellunge in new areas. It looks as though the musky might help solve the problem of too many stunted forage fish in reservoirs while adding a new sport fish. Muskies are not detrimentally competitive with the basses.

8596. Henegar, Dale L. (North Dakota Game and Fish Dept., Bismarck). 1966. INVESTIGATIONS IN FISH CONTROL. 3. MINIMUM LETHAL LEVELS OF TOXAPHENE AS A PISCICIDE IN NORTH DAKOTA LAKES. (Resource Publication 7, p. 1-16). Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin.

To determine minimum levels of toxaphene lethal to fishes in prairie lakes and reservoirs, 16 North Dakota lakes, ranging from 6.3 to 915 acres, were treated in 1959 and 1960 with concentrations of toxaphene ranging from 0.005 to 0.035 ppm. Physical and chemical studies were made of each area, hydrological maps were prepared, and test netting was carried out before and after treatment; application methods and equipment were according to North Dakota Game and Fish Department regulations. Mortality after treatment varied from incomplete, involving only young-of-the-year fish, to complete. A marked selective mortality pattern was noted: smaller fish succumbed at lower dosages; as the concentrations were increased, larger fish were killed. Duration of toxicity did not appear excessive—five of the seven lakes in which mortality was complete were successfully restocked within 7 months after treatment. (Auth.)

8597. Needham, Robert G. (Montana Dept. of Fish and Game, Bozeman). 1966. INVESTIGATIONS IN FISH CONTROL. 4. EFFECTS OF TOXAPHENE ON PLANKTON AND AQUATIC INVERTEBRATES IN NORTH DAKOTA LAKES. (Resource Publication 8, p. 1-16) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin.

Effects of low concentrations of toxaphene on plankton and larger invertebrates were studied in four North Dakota lakes (a fifth lake, untreated, was a control). Brachionus, Keratella, Trichocerca, Asplanchna, Polyarthra, Conochiloides, Daphnia, Ceriodaphnia, Bosmina, and Cyclops were dominant zooplankters; none exhibited marked reduction after treatment at 5 to 34 ppb. Most phytoplankter populations showed no obvious changes after treatment, except Aphanizomenon, which increased in all lakes. The posttreatment increase in South Lake Metigoshe was especially noticeable, since there was no increase in untreated North Lake Metigoshe. Several of the plant-inhabiting and bottom fauna decreased slightly after treatment, but this did not appear to be the result of toxaphene treatment. Tolerance levels for several zooplankters and other aquatic invertebrates were observed in controlled experiments. Rotifera was the most tolerant group, followed in order by Cladocera and Copepoda. Among larger intolerant, followed in order by Trichoptera, Odonata, Hemiptera, Ephemeroptera, Amphipoda, and Coleoptera. (Auth.)

8598. Warnick, Donald C. 1966. INVESTIGATIONS IN FISH CONTROL. 5. GROWTH RATES OF YELLOW PERCH IN TWO NORTH DAKOTA LAKES AFTER POPULATION REDUCTION WITH TOXAPHENE. (Resource Publication 9, p. 1-9) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin.

Growth rates of yellow perch that survived a toxaphene treatment in Brush and Long Lakes in North Dakota were calculated by the scale method for the 1960 and 1961 growing seasons. Brush Lake fish exhibited greatly increased growth rates for both growing seasons following the treatment. Increased growth rates were not evident for Long Lake fish until the 1961 growing season. At the end of the first full growing season after treatment the surviving yellow perch exceeded what may be considered to be the minimum harvestable size of 7 inches. The approximate concentration of toxaphene for reducing the density of fish populations is believed to be 25 percent of the rate determined for fish eradication in most North Dakota waters. (Auth.)

8599. Mahdi, Mahmoud Ahmed. 1966. INVESTIGATIONS IN FISH CONTROL. 6. MORTALITY OF SOME SPECIES OF FISH TO TOXAPHENE AT THREE TEMPERA-

TURES. (Resource Publication 10, p. 1-10) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin.

Lethal concentrations of toxaphene were determined for the stoneroller, golden shiner, goldfish, black bullhead, and bluntnose minnow in water at 53° F., 63° F., and 73° F.; rainbow trout were tested at 53° F. The TL_m and LD_{50} were obtained by graphic methods. For comparison a normit method was used with the bluntnose minnow data; all three methods gave similar results for the bluntnose minnow. In most experiments, concentrations of toxaphene needed to cause 50 percent mortality decreased as the temperature increased from 53° F. to 63° F. and to 73° F. The 96-hour TL_m values were below 0.1 ppm of toxaphene in all species tested. Goldfish were the most tolerant, with the other species showing so similar a sensitivity that they could not be effectively ranked by these data. (Auth.)

8600. Gaylord, William E., and Bernard R. Smith (Bur. of Commercial Fisheries, Biological Field Station, Ludington, Mich.). 1966. INVESTIGATIONS IN FISH CONTROL. 7. TREATMENT OF EAST BAY, ALGER COUNTY, MICHIGAN, WITH TOXAPHENE FOR CONTROL OF SEA LAMPREYS. (Resource Publication 11, p. 1-7) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin.

An experiment was conducted to determine whether toxaphene can be used to eradicate lake-dwelling sea lampreys and to determine its effect on fish populations. In East Bay, a 78-acre lake on the Sucker River, Alger County, Mich., an estimated concentration of 100 ppb was maintained for 14 days. The sea lamprey larvae were more resistant to toxaphene than were the fish, but a complete kill was indicated. One year after treatment, sea lampreys were absent from the lake, while the fish population had recovered. (Authors)

8601. Meehan, William R., and William L. Sheridan (Alaska Dept. of Fish and Game, Kodiak). 1966. INVESTIGATIONS IN FISH CONTROL. 8. EFFECTS OF TOXAPHENE ON FISHES AND BOTTOM FAUNA OF BIG KITOI CREEK, AFOGNAK ISLAND, ALASKA. (Resource Publication 12, p. 1-9) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin.

Big Kitoi Creek, on Afognak Island, Alaska, was treated with toxaphene in July 1961 to remove sculpins predaceous on pink salmon fry. Dispersion and penetration of toxaphene into the streambed were determined, as well as time required for detoxification. The population of sculpins in the creek before treatment was estimated at 30,000, of which 82 percent were in the size range considered predaceous on pink salmon fry. Extent of predation was determined by examination of stomachs of 180 sculpins. Considering the rate of predation, it was estimated that, of 847,500 $\pm$ 418,600 fry in the gravel 3 months before treatment, 12 percent may have been eaten by sculpins before the fry migrated to salt water. Bottom fauna decreased in numbers and weight after the toxaphene treatment: insects were completely eradicated; some other invertebrate groups were not completely eliminated. Posttreatment recruitment of bottom fauna began later in the summer; a year later the pretreatment levels of biomass had not yet been reached. Species composition of bottom fauna a year after treatment differed somewhat from that before treatment. Assuming that, if the creek had not been treated, 30,000 sculpins would have been present in the spring of 1962, then the treatment possibly saved approximately 135,000 pink salmon fry in 1962. (Authors)

8602. MacGregor, John S. (Bur. of Commercial Fisheries, Tuna Resources Lab., La Jolla, Calif.). 1966. SYNOPSIS ON THE BIOLOGY OF THE JACK MACKEREL. U.S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 526. 16 p.

This synopsis brings together all extant knowledge of the jack mackerel. This knowledge covers nomenclature, taxonomy, morphology, distribution, ecology and life history, population, exploitation, and protection and management. (Auth.)

8603. Hile, Ralph (Bur. of Commercial Fisheries Biological Laboratory, Ann Arbor, Mich.). 1966. U.S. FEDERAL RESEARCH ON FISHERIES AND

LIMNOLOGY IN THE GREAT LAKES THROUGH 1964: AN ANNOTATED BIBLIOGRAPHY. U.S. Fish and Wildlife Service Special Scientific Report --Fisheries No. 528. 53 p.

The annotated bibliography is preceded by a brief account of the Federal research program in fisheries and limnology in the Great Lakes in 1957-64. The bibliography covers 314 papers by staff members of the Bureau of Commercial Fisheries Biological Laboratory in Ann Arbor, Michigan, and 35 by associated scientists with whom the Laboratory had contractual or other cooperative arrangements; included also are patents issued to Laboratory personnel. A roster of Laboratory scientists as of December 31, 1964, is appended. (Auth.)

8604. Chandler, Garth. 1966. THE CASE OF THE VANISHING GAMEFISH. Boating, 20(1): 39-41.

Description of the Cooperative Game Fish Tagging Program being conducted by the Woods Hole Oceanographic Institution, in the Atlantic, and the Tiburon Marine Laboratory, in the Pacific. Findings will be used to chart the migration and spawning habits of important marine game fish. With such statistics it may be possible to work out agreements with the Japanese and Russian commercial fishing interests to halt the present decline in the number and size of some of our most important marine big-game fishes.

8605. Oertle, V. Lee. 1966. AMAZING SALTON SEA. Sportfishing 2(10): 28, 29, 52-54.

An interesting history of the creation of Salton Sea and the many attempts to establish a sport fishery in it. The introduction of pile worms (Neanthes) in 1929, and a few yellowfin croakers, and subsequent stocking of a few orangemouth corvina and sargo, finally produced the current fantastic sport fishery. The gradual increase in salinity of the water and/or the pesticides from the basin farmland may soon end this recently developed fishery.

8606. Drummond, Robert A. 1966. REPRODUCTION AND HARVEST OF CUTTHROAT TROUT AT TRAPPERS LAKE, COLORADO. Colorado Game, Fish and Parks Comm. Special Report No. 10. 26 p.

Studies of natural reproduction, as related to selected influential environmental factors, and fishermen harvest of cutthroat trout were made during 1960-65 at Trappers Lake, Colorado. It was found that most cutthroat trout did not spawn until their fourth year of life. A general decline in the number of spawners was noted in Cabin Creek during the period of study. There was no predictable relationship between spawner escapement and year-class abundance. Fry recruitment from Cabin Creek was consistently larger than that from Heberton or Frasier Creeks. Water flows, at the outlet of Trappers Lake, were directly correlated with fry recruitment from Cabin Creek. Snow-water-content data also were directly correlated with water flows. From these data, fry recruitment from Cabin Creek was forecasted directly using snow-water-content data. Fishing pressure, effort and harvest increased from 1960 through 1962, then declined in 1963. As expected, fishing pressures were even less in 1964 due to the initiation of a 10 inch size limit. Age-groups II and III predominated in the catch during all years of study except 1964 and 1965. The number of trout 14 inches in length or larger bacame increasingly less abundant in the catch each year (1960-63). The number of trout 10 to 14 inches in length increased in the catch during the same period and this was attributed to fishermen or tackle selectivity.

8607. Colborn, Leon G. 1966. THE LIMNOLOGY AND CUTTHROAT TROUT FISHERY OF TRAPPERS LAKE, COLORADO. Colorado Dept. of Game, Fish and Parks Special Report No. 9. 26 p.

The limnology and fishery of Trappers Lake, Colorado were studied during the summers of 1962 and 1963. These investigations included: chemical aspects of lake, morphometry, mapping of aquatic vegetation, quantitative studies of the plankton and benthos, range in length of age groups, growth rates, and length-weight relationship of juvenile cutthroat trout.

8608. Tavolga, William N. 1966. THE AUDIO-ICHTHYOTRON — THE EVOLUTION OF AN INSTRUMENT FOR TESTING THE AUDITORY CAPACITIES OF FISHES. Trans. New York Acad. Sci., 28(6): 706-714.

Studies concerning the auditory capacities of fish, the relation of fish sounds to behavior, and the effect of the acoustic environment on hearing in fish.

8609. Hunt, Robert L. 1966. PRODUCTION AND ANGLER HARVEST OF WILD BROOK TROUT IN LAWRENCE CREEK, WISCONSIN. Wisconsin Conservation Dept. Technical Bulletin No. 35. 52 p.

Production of wild brook trout in Lawrence Creek was calculated monthly during 1960-64, for all age groups, and throughout the lifespan of the 1959-61 year classes. Contemporary statistics on the sport fishery were derived from a compulsory creel census. Three trout population estimates made annually with electrofishing gear provided the basic data for estimating monthly numerical densities. Growth data were collected monthly from known-age trout during 1963 and in April, June, and September during all other years. Data summarizing growth, biomass, angler harvest and production for 60 consecutive months are presented. Annual production in the entire stream varied by only 15% during 1960-64, ranging from 84-96 pounds per acre. Production by age 0 and age I trout accounted for 81-95% of annual production. Production by the 1959-61 year classes during their lifespans amounted to 157, 68, and 119 pounds per acre, respectively. Production was greatest during the first year of life for all three year classes. During the 1961-64 trout fishing seasons 442-752 brook trout 8 inches (minimum legal size limit) or larger were creeled annually. Annual harvests amounted to 9-14 pounds per acre. The bulk of the catch consisted of age II trout. Although production varied greatly within age groups from year to year, annual production by all age groups consistently approached 90 pounds per acre. The trout food supply did not appear to critically limit annual production. Data concerning accumulated production at the end of successive years of life, and the amounts still present as the standing crop, or removed by anglers, or removed by natural mortality are presented and discussed for three-year classes of brook trout. During the lifespan of a year class of brook trout in Lawrence Creek production is equivalent to less than one-half of 1% of "potential production" (defined as the product of the number of emerging fry and the weight attained by the last survivor).

8610. Kent, Fred, and Frank F. Hooper (Inst. for Fisheries Research, Univ. Museums Annex, Ann Arbor, Michigan). 1966. SYNTHETIC DETERGENTS: THEIR INFLUENCE UPON IRON-BINDING COMPLEXES OF NATURAL WATERS. Science, 153(3735): 256-257.

Organic compounds extracted from Michigan lakes and streams and added to algal cultures increase the growth rate of the green alga (Chlamydomonas reinhardi) when iron is present. Two-dimensional paper chromatography has shown that the iron is complexed by organic fractions containing an amine group. When isolated from natural waters containing a concentration of over 0.3 ppm alkyl benzene sulfonate, these compounds do not show an iron-binding capacity. Separation of this sulfonate from the amine complexes restores the iron-binding capability. These findings suggest that detergents may influence the mobility of iron by reducing the number of binding sites, and in this way may have an important secondary effect upon the primary production of lakes and streams. (Authors)

8611. Mark, R. F., and T. M. Davidson (Div. of Biology, California Institute of Technology, Pasadena). 1966. UNIT RESPONSES FROM COMMISSURAL FIBERS OF OPTIC LOBES OF FISH. Science, 152(3723): 797-799.

The paired optic lobes of teleost fish are connected by two commissures. One of these, the tectal commissure, was studied with metal microelectrodes. Fibers are rhythmically active for prolonged periods in the dark and respond to light by a decrease in the rate of discharge. There is a rebound acceleration when the light is turned off. Each fiber is influenced by light in one eye only, and there is no response when light is projected into the opposite eye. This behavior resembles

the "off" response recorded from the optic lobes and the optic nerve of fish. Unlike most units from the visual pathways of lower animals single commissural fibers do not seem to give any recognizable response to patterned input such as small light or dark objects or small light sources stationary or moving anywhere in the visual field, nor do they respond to a vertical black bar moved over a white background. (Authors)

8612. Bennett, Edward B. 1966. MONTHLY CHARTS OF SURFACE SALINITY IN THE EASTERN TROPICAL PACIFIC OCEAN. Bull. Inter-American Tropical Tuna Comm., La Jolla, Calif. 11(1): 3-44.

Mean monthly maps of surface salinity of the eastern Pacific Ocean were prepared using all available data. Charts were also made of the distribution by one-degree quadrangles of the number of surface salinity observations for each month. Features of interest in the surface salinity distribution are discussed briefly, especially with reference to temporal changes. (Auth.)

8613. Kume, Susumu, and Milner B. Schaefer. 1966. STUDIES ON THE JAPANESE LONG-LINE FISHERY FOR TUNA AND MARLIN IN THE EASTERN TROPICAL PACIFIC OCEAN DURING 1963. Bull. Inter-American Tropical Tuna Comm., La Jolla, Calif. 11(3): 103-170.

During 1963, the area of operation of the Japanese long-line fishery in the eastern Pacific further expanded, and total fishing effort increased. Charts are presented showing the distribution of effort and of catch-rates, by species, for major fishing areas; and showing catch-rates by species, by quarters of the year, by areas of one-degree of latitude and longitude. In the newly-exploited region north of 10°N, yellowfin and striped marlin are principal elements of the catch, while in the newly-fished region south of the former fishing areas, south of about 20°S, albacore dominate in the catch. Continued decline in catch rates of bigeye tuna, associated with increased fishing effort, indicates that there has been a real decrease in abundance of this species, and that it may have resulted from effects of the fishery on the stock. Changes in catch rates of yellowfin tuna seem to be associated with effects on the stock by both the long-line fishery and by the near-surface fishery by purse-seiners and bait-boats. Over the short series of years for which data are available, there are no discernible trends in apparent abundance of striped marlin or albacore. Information is presented concerning seasonal and geographical distributions of spawning yellowfin tuna, based on examination of gonads. Analysis of data on size composition of yellowfin tuna for 1958-1964 indicates that the long-line fishery is becoming increasingly dependent on the most recently recruited year class, further confirming the effect of the fishery on the stock. The long-line fishery now takes nearly all of its catch of yellowfin tuna from two year-classes each year, during their third and fourth years of life. (Authors)

8614. Rogers, Wilmer A., and Thomas L. Wellborn, Jr. (Fisheries Laboratory, Agricultural Experiment Sta., Auburn Univ., Auburn, Ala.). 1965. STUDIES ON Gyrodactylus (Trematoda:Monogenea) WITH DESCRIPTIONS OF FIVE NEW SPECIES FROM THE SOUTHEASTERN U.S. Jour. of Parasitology, 51(6): 977-982.

Five new species of Gyrodactylus are described, namely G. aphredoderi from Aphredoderus sayanus (Gilliams), G. gambusiae from Gambusia affinis (Baird and Girard), G. heterodactylus from Elassoma zonatum Jordan, G. percinae from Percina nigrofasciata (Agassiz), and G. protuberus from Notropis uranoscopus Suttkus. Comparative studies were made on G. bullatarudis Turnbull from Lebistes reticulatus Peters and on G. macrochiri Hoffman and Putz from Lepomis punctatus (Valenciennes) and Chaenobryttus gulosus (Cuvier). Lepomis punctatus and Chaenobryttus gulosus are reported as new hosts for G. macrochiri. All host fishes were collected from Alabama and Florida. (Authors)

8615. Roberts, Larry S. 1965. Ergasilus tenax sp. n. (Copepoda:Cyclopoida) FROM THE WHITE CRAPPIE, Pomoxis annularis Rafinesque. Jour. of Parasitology, 51(6): 987-989.

Ergasilus tenax sp. n. is described from the freshwater fish, Pomoxis annularis, collected in Texas. E. tenax differs from all other Ergasilus spp. in that the terminal segment of each antenna is modified to clasp the terminal segment of the other. (Auth.)

8616. Bullock, Wilbur L. (Zoology Dept., Unov. of New Hampshire, Durham). 1966. Entamoeba gadi sp. n. FROM THE RECTUM OF THE POLLOCK, Pollachius virens (L., 1758), WITH SOME OBSERVATIONS ON ITS CYTOCHEMISTRY. Jour. of Parasitology, 52(4): 679-684.

Entamoeba gadi sp. n. is described from the rectum of the pollock, Pollachius virens. This is the first report of a species of Entamoeba from a North American fish. Cysts are mainly uninucleate with a large glycogen vacuole and numerous chromatoidal bodies. Some binucleate cysts also occur. There is no evidence of pathogenicity. Cannibalistic cystophagy is common in all heavily infected fish. One apparent case of cannibalism of a trophozoite was observed. Although large numbers of flagellates (Chilomastix and Hexamita) were also present, these were never ingested. Histochemical tests indicate the presence of glycogen in the trophozoites but no other PAS-positive material or acid mucopolysaccharides. Cysts contained large concentrations of glycogen and a nonglycogen, PAS-positive material in the cyst wall. The prominent cytoplasmic basophilia of both the trophozoites and the cysts is indicated, by the use of ribonuclease, to be due to the presence of RNA. (Auth.)

8617. Wayman, C.H., and A.T. Miesch (U.S. Geological Survey, Denver, Colorado). 1965. ACCURACY AND PRECISION OF LABORATORY AND FIELD METHODS FOR THE DETERMINATION OF DETERGENTS IN WATER. Water Resources Research, 1(4): 471-476.

The accuracy and precision of two field methods and a laboratory method for determining detergent (alkylbenzenesulfonate) in water have been investigated. Commercially available kits were used for the field methods. A total of 660 determinations were made by two analysts on prepared solutions containing both branched-chain and straight-chain detergents. One of the field methods contains large amounts of negative bias that vary with concentration level. The other field method has poorer precision than the laboratory method but no large amount of bias. (Authors)

8618. Sobel, Matthew J. (Stanford Univ. and Stanford Research Inst., Stanford, California). 1965. WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS. Water Resources Research, 1(4): 477-487.

Recent years have seen a marked increase in the rate of investment in facilities for water quality control and a concurrent recognition of the need to program water resource use on a regional basis. This paper outlines the nature of regional water quality systems and presents programming models for several water quality improvement problems. A linear programming formulation of a static improvement in quality is contrasted with a traditional policy for programming improvements; the traditional policy results in a mixed integer problem. The maximization of the ratio of benefits to costs of an improvement program is transformed to a linear programming problem. A stochastic natural environment leads to other programming models. A discussion of the application of least-cost models terminates the paper. (Auth.)

8619. Ballintijn, C.M., and G.M. Hughes (Dept. of Zoology, Cambridge, England). 1965. THE MUSCULAR BASIS OF THE RESPIRATORY PUMPS IN THE TROUT. Jour. of Experimental Biology, 43(2): 349-362.

An account is given of the muscles and skeleton of the trout head and of the mechanisms coupling the different functional components of the skull. The activity of the main respiratory muscles has been recorded electromyographically and simultaneously with pressure and movement recordings from the buccal and opercular cavities. The muscles may be divided into two main groups according to whether they are active during the expansion or contraction phase of the pumps.

The protractor hyoideus (geniohyoideus) was found to be active only during the contraction phase. There are differences in the muscles that are active, depending upon the depth of ventilation. Shallow ventilation is maintained by the adductor mandibulae, adductor arcus palatini et operculi, and levator hyomandibulae et arcus palatini. During deeper ventilation the sternohyoideus, protractor hyoideus and hyohyoideus muscles come into action. Only during strong ventilation does contraction of the dilator operculi play a part in opercular abduction. There are variations in the pattern of muscular activity in different individuals and also in the same individual at different times. Such differences in muscular activity are not clearly reflected in the movement and pressure recordings, because of the complex couplings between different parts of the pumping mechanism. As contraction of most muscles affects both the opercular and buccal cavities it is concluded that a model of teleost ventilation based upon a double pumping mechanism must incorporate the couplings between these pumps. (Authors summ.)

8620. Holmes, W.N., and I.M. Stainer (Dept. of Biological Sciences, Univ. of California, Santa Barbara). 1966. STUDIES ON THE RENAL EXCRETION OF ELECTROLYTES BY THE TROUT (Salmo gairdneri). Jour. of Experimental Biology, 44(1): 33-46.

A decline in the renal excretory rates of water and electrolytes occurred in the trout, Salmo gairdneri, at the time of smolting. This decline appeared to be almost entirely attributable to a reduction in the glomerular filtration rate. Although there was an increase in the total urine osmolal concentration as the urine flow decreased, this decrease was insufficient to maintain the total osmolal excretory rate at a constant level. The sodium, potassium and chloride concentrations of the urine only accounted for approximately 50% of the observed real osmolality of the urine in both the smolting and the non-smolting fish; the difference may have been due to the presence of osmotically active nitrogenous compounds. No selective change in the tubular reabsorptive or secretory processes were found to accompany the reduction in glomerular filtration at the time of smolting. The urine:plasma-ion concentration ratios showed no evidence for any selective concentration in the renal tubule. During the transition from the smolting to the post-smolting condition the renal excretory pattern was restored to that of the pre-smolting trout. The possible significance of these changes in relation to the excretory changes known to occur during the adaptation of salmonid fishes to a marine environment are discussed. (Authors summ.)

8621. Buss, Keen (Benner Spring Fish Res. Sta., Bellefonte, Pennsylvania). 1966. THE FACTS CONCERNING THE PRODUCTION AND STOCKING OF WARMWATER FISHES. Pennsylvania Angler, 35(6): 5-8.

Discusses the problems of producing warmwater game fish in Pennsylvania, but is applicable to other states. It provides comparisons of the relative effectiveness of stocking trout and warmwater species in the maintenance of a catchable supply. Easy-to-read review of certain phases of fishery management that should be known by anglers — and remembered by fishery workers.

8622. Kern, Cal. 1966. AN EXPERIMENT WITH STEELHEADS. Pennsylvania Angler, 35(6): 19-21.

Over 42,000 steelhead trout were released into Pennsylvania streams as a project of the Lehigh County Fish and Game Protective Association from February 1963 to February 1966. It is hoped that an ocean-run population of rainbow trout can be established in Pennsylvania streams.

8623. Thomas, Bill. 1966. TRADEMARK TROUT. Sports Afield, 156(2): 41, 64.

A brief account of the development and stocking of the golden rainbow trout in West Virginia.

8624. Peery, Charles H. 1966. FEE FISHING FOR TROUT. Virginia Wildlife, 27(8): 6-7.

For the past three years a section of Big Tumbling Creek in Virginia has been

operated by the State on a fish-a-day-for-a-dollar basis. At present 4 miles of the stream are managed by the State, which hopes to add another 1.3 miles downstream. One dollar permits the fisherman to creel five rainbow trout, but uninjured fish may be released. Proceeds from the sale of daily fishing permits provides about thirty-two cents per trout stocked. Use of the stream has increased each year.

8625. Unger, Iris. 1966. ARTIFICIAL REEFS. American Littoral Society Special Publication Number 4, Highlands, N.J. 74 p.

Just as the carrying capacity of range land can be increased by land improvement, so may the carrying capacity of a sea bottom be increased by habitat improvements. This is particularly true where flat, sandy, coastal plains are unbroken by reefs, valleys or mounts. In temperate waters, many fish range the ocean plains in yearly migrations taking up temporary or seasonal residence where they find good living conditions — food, protection, and comfortable surroundings. Where these conditions do not exist in nature, we can often create them by constructing artificial reef structures and thereby attracting for our purposes of fishing or fish watching, such species as may be of interest to us. The same idea can apply in our sub-tropical seas where fishes may be less migratory but do continually explore for new permanent living space.

8626. Walker, Charles R., Roland J. Starkey, and Leif L. Marking (Fish Control Lab., Bur. Sport Fisheries & Wildlife, La Crosse, Wisc.). 1966. INVESTIGATIONS IN FISH CONTROL. 9. RELATION OF CHEMICAL STRUCTURE TO FISH TOXICITY IN NITROSALICYLANILIDES AND RELATED COMPOUNDS. (Resource Publication 13, p. 3-12) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisc.

Relations between chemical structures of salicylanilides and benzanilides and their toxicity to rainbow trout and goldfish were evaluated in standard, static bioassays. Single and multiple substitutions of alkyl-, nitro-, and halo- groups were tested. Substitution of hydroxy- at ortho (2) accompanied by nitro- at meta (3) or sub-meta (5) on the benzoic acid moiety are basic requirements for toxic activity against fish. Halogenation at para (4') markedly affects the selective toxicity of the compounds to either rainbow trout or goldfish. (Authors)

8627. Marking, Leif L. (Fish Control Lab., Bur. Sport Fisheries & Wildlife, La Crosse, Wisc.). 1966. INVESTIGATIONS IN FISH CONTROL. 10. EVALUATION OF p,p'-DDT AS A REFERENCE TOXICANT IN BIOASSAYS. (Resource Publication 14, p. 3-10) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisc.

p,p'-DDT was tested as a reference standard toxicant against 19 species of freshwater fish, including 39 lots from 10 sources. In particular, the rapidity, nonselectivity, and consistency of its toxicity to fish were evaluated in 96-hour static bioassays. The chemical was rapidly and consistently toxic to lake trout, carp, green sunfish, bluegill, and yellow perch. It lacked either rapid or consistent toxicity to rainbow trout, brook trout, goldfish, fathead minnows, and longear sunfish in 96-hour tests. Thus, p,p'-DDT is of limited usefulness as a reference standard toxicant in large bioassays with many species of fish. (Auth.)

8628. Schoettger, Richard A., and Arnold M. Julin (Fish Control Lab., Bureau of Sport Fisheries & Wildlife, La Crosse, Wisc.). 1966. INVESTIGATIONS IN FISH CONTROL. 11. EVALUATION OF AN ELECTRONIC METHOD OF MEASURING HEMATOCRITS OF FISH. (Resource Publication 15, p. 3-11) Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisc.

Conductivity measurements of mammalian blood are considered satisfactory estimates of hematocrit. The YSI Electronic Hematocrit gives rapid and reproducible results with fish blood, and the readings can be corrected to microhematocrit values. In the low hematocrit range, however, readings do not change proportionately with microhematocrits; they are difficult to correct; but they may prove useful as a gross, rapid method for detecting anemia. Electrolyte and

protein concentrations in fish blood influence the electronic hematocrit; the relative size of erythrocytes may also. (Authors)

8629. La Roche, Gilles, A.N. Woodall, C. L. Johnson, and J.E. Halver (Donner Laboratory, Univ. of California, Berkeley). 1966. THYROID FUNCTION IN THE RAINBOW TROUT (Salmo gairdnerii Rich.). II. EFFECTS OF THYROIDECTOMY ON THE DEVELOPMENT OF YOUNG FISH. General and Comparative Endocrinology, 6(2): 249-266.

Radiothyroidectomy markedly reduced the rate of growth and development in juvenile rainbow trout. Radiothyroidectomized fish when compared to intact controls on identical diets showed the following differences: (a) reduced growth rate; (b) high degree of pigmentation due to an increase in the number of pigment cells per unit surface area; (c) smaller head which appeared associated with reduced calcification and a higher amount of cartilage; (d) smooth skin resulting from a reduction in the size of scales; (e) thinner skin resulting from thinner dermal connective tissue; (f) extensive abdominal fat deposits which were not reflected by increased serum cholesterol concentration; (g) virtual absence of sexual development at two and one-half years of age; (h) a significant decrease in number of red cells, hematocrit and hemoglobin as well as the presence of atypical circulating erythrocytes; (i) neuromuscular anomalies as indicated by seizures which confer a poor degree of coordination. The data suggest that chronic hypothyroidism due to radiothyroidectomy impairs calcification by limiting bone matrix formation. The metabolic implications related to these changes are discussed. (Authors)

8630. Wolf, Ken (Bur. Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va.). 1966. INFECTIOUS PANCREATIC NECROSIS (IPN) OF SALMONID FISHES. Fish Disease Leaflet 1, Bureau of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va. 4 p.

Infectious pancreatic necrosis, commonly called IPN, is a viral infection of trouts, characteristically seen as a clinically distinctive acute disease causing high mortality in fry and fingerlings and occasionally in larger fish. IPN also commonly occurs as a benign and inapparent infection in yearling and adult "carrier" fish.

8631. Meyer, Fred P. (Bur. Sport Fisheries and Wildlife, Fish Farming Experimental Station, Stuttgart, Ark.). 1966. PARASITES OF FRESHWATER FISH. II. PROTOZOA. 3. Ichthyophthirius multifilis. Fish Disease Leaflet 2, Bureau of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va. 4 p.

Ichthyophthiriasis, or "Ich", is probably the most serious disease of catfishes. Losses due to this disease are not restricted to catfishes, however; almost all cultured fishes are susceptible.

8632. Bowen, J.T., and R.E. Putz (Bur. Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va.). 1966. PARASITES OF FRESHWATER FISH. IV. MISCELLANEOUS. 3. PARASITIC COPEPOD Argulus. Fish Disease Leaflet 3, Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va. 4 p.

"Fish lice" of the genus Argulus (suborder Branchiura) are common parasitic copepods of freshwater fish and, at times, frogs and salamanders. Argulids may cause mortality among wild fish and are often a serious hatchery problem.

8633. Bowen, J.T. (Bur. Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va.). 1966. PARASITES OF FRESHWATER FISH. IV. MISCELLANEOUS. 4. PARASITIC COPEPODS Ergasilus, Achtheres, and Salmincola. Fish Disease Leaflet 4, Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va. 4 p.

8634. Meyer, Fred P. (Bur. Sport Fisheries and Wildlife, Fish Farming Experimental Station, Stuttgart, Ark.). 1966. PARASITES OF FRESHWATER FISHES.

IV. MISCELLANEOUS. 6. PARASITES OF CATFISHES. Fish Disease Leaflet 5, Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va. 7 p.

8635. Parisot, Thomas J., and James W. Wood (Bur. Sport Fisheries and Wildlife, Western Fish Disease Lab., Seattle, Wash.). 1966. FISH MYCOBACTERIOSIS (TUBERCULOSIS). Fish Disease Leaflet 7, Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Leetown, W. Va. 2 p.

8636. van Vuuren, L. R. J., P. G. J. Meiring, M. R. Henzen, and F. F. Kolbe (Natl. Inst. for Water Research, Council for Scientific and Industrial Research, Pretoria, South Africa). 1965. THE FLOATATION OF ALGAE IN WATER RECLAMATION. Internatl. Jour. Air and Water Pollution, 9(12): 823-832.

A simple and economic technique has been developed for the continuous removal of planktonic algae from water. By floatation of flocculated algae, easy removal was achieved by surface skimming. To bring about floatation, use was made of the high concentrations of dissolved oxygen which originate in water through the photosynthetic activity of algae. By pre-aeration under pressurized conditions, floatation can also be obtained at times when dissolved oxygen concentrations are low. This unit process can be incorporated with great advantage in water reclamation plants for treating water extracted from maturation ponds. It can also be used for removal of algae from stabilization pond effluent prior to discharge into a receiving water, and opens new possibilities of harnessing the natural self-purification potential of an open body of water. By flocculation and removal of algae, the chemical quality of the effluent, apart from the physical quality, is also substantially improved. By means of a specially designed inlet system, foam formation can be improved and, therefore, ABS removal promoted. (Authors)

8637. Mount, Donald I. (U. S. Public Health Service, R. A. Taft Sanitary Eng. Center, Cincinnati, Ohio). 1966. THE EFFECT OF TOTAL HARDNESS AND pH ON ACUTE TOXICITY OF ZINC TO FISH. Internatl. Jour. Air and Water Pollution, 10(1): 49-56.

Four-day tests of the toxicity of zinc sulfate to minnows were made at 3 pH levels (6, 7, and 8) and 3 total hardness levels (50, 100, and 200 ppm as $CaCO_3$). Continuous-flow tests were used, and zinc concentrations were measured for each test. Zinc was most toxic at pH of 8 and hardness of 50 ppm and least toxic at pH 6 and hardness of 200 ppm. At any given hardness, zinc was always more toxic at a high pH than at a low pH. The results are in disagreement with most published work possibly because the flow-through test system, unlike static test systems, keeps precipitated zinc in suspension. (Auth.)

8638. Warinner, J. E., and M. L. Brehmer (Virginia Inst. of Marine Science, Gloucester Point, Va.). 1966. THE EFFECTS OF THERMAL EFFLUENTS ON MARINE ORGANISMS. Internatl. Jour. Air and Water Pollution, 10(4): 277-289.

The assimilation of carbon by the natural phytoplankton populations of the York River is affected by an artificial increase in water temperature. During the winter months temperature changes, which are normally experienced during passage through a power plant condenser, enhance primary production. When river water reached a temperature of 10 to 15° C., a 3 degree rise in temperature through the condenser resulted in an increased carbon assimilation, but a higher temperature rise (more than 5.5° C.) resulted in decreased carbon assimilation. Heating river water which was above 15° C. always depressed primary production significantly if the temperature rise was above 5.5° C. In general, the greater the temperature rise, the greater the depression of production. (Authors summ.)

8639. Pickering, Quentin H. (U. S. Public Health Service, R. A. Taft Sanitary Eng. Center, Cincinnati, Ohio). 1966. ACUTE TOXICITY OF ALKYL BENZENE SULFONATE AND LINEAR ALKYLATE SULFONATE TO THE EGGS OF THE FATHEAD MINNOW, Pimephales promelas. Internatl. Jour. Air and Water

Pollution, 10(5): 385-391.

The detergent industry of the United States has converted from the use of alkyl benzene sulfonate (ABS) to more readily biodegradable products in which linear alkylate sulfonate (LAS) is the major detergent. Bioassays were conducted with ABS and LAS to determine the relative toxicity of these surface-active agents to eggs of the fathead minnow. In these continuous-flow tests, the toxicity of both detergents increased (TL_m value lowered) with an increase in time of exposure. Using the combined results of four tests the 9-day TL_m value of 6.4 mg ABS/l. was about one-half of the 1-day TL_m value. The toxicity of LAS increased from a 1-day TL_m value of 3.4 mg LAS/l. to a 9-day TL_m value of 2.3 mg/l. Survival of fathead minnow eggs and hatched fry was similar to the controls in the test concentrations of 0.90 mg LAS/l. and 2.4 mg ABS/l. On the basis of 9-day tests, LAS is more than twice as toxic as ABS.

8640. Pickering, Quentin H., and Croswell Henderson (U.S. Public Health Service R.A. Taft Sanitary Eng. Center, Cincinnati, Ohio). 1966. THE ACUTE TOXICITY OF SOME HEAVY METALS TO DIFFERENT SPECIES OF WARMWATER FISHES. Internatl. Jour. Air and Water Pollution, 10(6/7): 453-463.

In addition to the influence of time and the physical and chemical variables on toxicity, the data from these bioassays indicate that the comparative toxicity of any group of compounds varies with the test species. With all four species in soft water, copper was the most toxic metal and hexavalent chromium was the least toxic. With the other metals, however, relative toxicity varied with the test species. Thus, any statement comparing the toxicity of one metal against another must be qualified by indicating the test species; and conversely, the relative resistance of two species should be compared only in terms of a specific toxicant. These static acute bioassays in which two waters widely different in pH, alkalinity, and hardness were used, indicate the great influence of different dilution waters on toxicity. Thus, no attempt was made to quantitate the various toxicity factors between the soft and hard water; i.e., amount of metal in solution, calcium antagonism, etc. With the metals studied, the fathead minnow appears to be more affected by the variables than does the bluegill. The TL_m values of these heavy metals are a direct measure of the acute toxicity under the experimental conditions. Such concentrations would be expected to cause fish mortality under most environmental conditions and would not be safe for fish, even under conditions of short exposure. (Authors summ.)

8641. Cooper, Richard A. (Bur. of Commercial Fisheries Biological Laboratory, Boothbay Harbor, Maine). 1966. MIGRATION AND POPULATION ESTIMATION OF THE TAUTOG, Tautoga onitis (Linnaeus), FROM RHODE ISLAND. Trans. American Fisheries Soc., 95(3): 239-247.

Approximately 3,000 adult tautog (Tautoga onitis Linaeus), were tagged with fluorescent ribbons at four spawning locations in the West Passage of Narragansett Bay during the spring of 1961. The distribution of 230 tag returns over a 2-1/2-year period indicated that the Narragansett Bay Tautog is local to Rhode Island's coastal waters. The adult population inhabits the bay and inshore waters from early May until late October. During the winter, tautog occupy deeper areas with rugged bottom topography, where they are relatively dormant and forage little for food. Discrete spawning groups exist in the northern half of the bay during May and June. These groups are thoroughly mixed during the remainder of the year. A high percentage of adults returned to the same spawning locations in the upper portion of Narragansett Bay in the spring of 1962. The size of the Rhode Island population of adult tautog was estimated by the Schnabel and Schumacher multiple-census methods. Twenty-two census samples were obtained by divers counting the number of tagged and non-tagged fish underwater. Estimates ranged from 300,000 to 400,000. (Auth.)

8642. Dryer, William R. (Bur. of Commercial Fisheries, Ashland, Wisc). 1966. BATHYMETRIC DISTRIBUTION OF FISH IN THE APOSTLE ISLANDS REGION, LAKE SUPERIOR. Trans. American Fisheries Society, 95(3): 248-259.

Records of seasonal and "all-season" (April-December) bathymetric distribution are given for 17 species of fish taken in bottom trawls and experimental gill nets fished on the bottom in 1958-63 in the Apostle Islands region of Lake Superior. The data are based on catches from 578 trawl tows at 2-59 fathoms and 301,900 linear feet of gill nets fished at 2-89 fathoms. Size of the fish varied widely among different species from the same gear and the same species from different gears. Seasonal differences in depth distribution were greatest for lake trout, bloaters, round whitefish, and older smelt, which exhibited an inshore movement in the summer and fall, and for longnose suckers, which migrated to deeper water with progress of the seasons. The all-season bathymetric distributions varied considerably among species. Round whitefish, 0- and I-group smelt, longnose suckers, ninespine sticklebacks, and johnny darters were most abundant at < 10 fathoms. Concentrations of lake trout, lake herring, lake whitefish, older smelt, trout-perch, and burbot were greatest at 10-29 fathoms. Pygmy whitefish were most common at 30-39 fathoms, bloaters and spoonhead sculpins at 40-49 fathoms, and shortjaw ciscoes, slimy sculpins, and fourhorn sculpins at 50-59 fathoms. The kiyi was most abundant at 70-79 fathoms. (Auth.)

8643. Deuel, David G., John R. Clark, and A. J. Mansueti (Bur. of Sport Fisheries and Wildlife, Sandy Hook Marine Lab., Highlands, N. J.). 1966. DESCRIPTION OF EMBRYONIC AND EARLY LARVAL STAGES OF BLUEFISH, Pomatomus saltatrix. Trans. American Fisheries Soc., 95(3): 264-271.

Eggs of the bluefish (Pomatomus saltatrix) were fertilized and cultured to provide type specimens for identification of pelagic egg and larval stages in field collections. Bluefish eggs, held in seawater of 20° C. and 32.5 °/oo salinity, hatched in 46 to 48 hours. The yolk was nearly consumed 2 days after hatching. Larvae grew slowly and all died by the 8th day after hatching. Identifying characteristics are described for various stages of development of eggs and early larvae and illustrations of typical stages are provided. (Authors)

8644. West, Jerry L., and F. Eugene Hester (North Carolina Coop. Fishery Unit, North Carolina State Univ., Raleigh, N. C.). 1966. INTERGENERIC HYBRIDIZATION OF CENTRARCHIDS. Trans. American Fisheries Soc., 95(3): 280-288.

A study was undertaken to attempt all possible crosses among four species of centrarchids, representing four distinct genera, by artificial stripping and fertilization. The species used were Micropterus salmoides (Lacépède), the largemouth bass; Chaenobryttus gulosus (Cuvier), the warmouth; Lepomis macrochirus Rafinesque, the bluegill; and Pomoxis nigromaculatus (LeSueur), the black crappie. Hybridization success was used as an indication of the phylogenetic relationship of the parental species. Of the 12 possible hybrid crosses, fertilization of eggs was obtained in all crosses and hatching was obtained in all crosses except female Pomoxis X male Micropterus and female Pomoxis X male Chaenobryttus. Offspring survived to a size of 2.5 inches total length or larger in the following five crosses: female Micropterus X male Chaenobryttus, female Chaenobryttus X male Micropterus, female Chaenobryttus X male Lepomis, female Pomoxis X male Lepomis, and female Micropterus X male Lepomis. Only Chaenobryttus X Lepomis has previously been reported. Further studies are underway to determine the growth and reproductive characteristics of three of the hybrid types. (Authors)

8645. Gilderhus, Philip A. (Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Research Lab., La Crosse, Wisc.). 1966. SOME EFFECTS OF SUBLETHAL CONCENTRATIONS OF SODIUM ARSENITE ON BLUEGILLS AND THE AQUATIC ENVIRONMENT. Trans. American Fisheries Soc., 95(3): 289-296.

Bluegills were exposed to sodium arsenite at various concentrations and treatment frequencies in outdoor pools. The effects of the treatments on the fish and invertebrates in the pools were assessed. Applications totaling 4.0 ppm or more of $NaAsO_2$ during the experiment were reflected in reduced survival and growth of the fish, with immature fish being affected to a greater degree than adults. Some pathological changes were observed in adults. Substantial residues

of arsenic were found in the water, bottom soil, and throughout the organs and flesh of the bluegills at the termination of the experiment. Bottom fauna and plankton populations were reduced or inhibited in several pools with the highest concentrations of the herbicide. (Auth.)

8646. Andrews, Austin K., Charles C. Van Valin, and Bruce E. Stebbings (Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Research Lab., Marion, Ala.). 1966. SOME EFFECTS OF HEPTACHLOR ON BLUEGILLS (Lepomis macrochirus). Trans. American Fisheries Soc., 95(3): 297-309.

In complementary studies of the chronic effects of heptachlor on bluegills, four similar earthen ponds were treated once with different concentrations of heptachlor, and the fish in six plastic pools were routinely fed different levels of heptachlor. A fifth pond and two plastic pools were used as controls. Higher dosages resulted in higher concentrations of heptachlor residues, more pronounced tissue pathology, and higher mortality in the test fish. Heptachlor reached a maximum in the pond fish about 3 days after treatment, and could no longer be found in the fish or mud after 56 days. The fish fed continuous levels of heptachlor developed their highest residues at 56 days. Invertebrate populations in the two higher treatment level ponds were eliminated. Lesser effects appeared in the two lower concentrations. At the termination of the experiment, invertebrate populations in the treated ponds and the control were not significantly different, and had achieved or surpassed pretreatment levels. Degenerative liver lesions became pronounced in fish from the two higher exposure ponds, but a heavy infestation of trematode metacercariae in the fish of all the test ponds, except the control, clouded further interpretation of histopathological examinations. Pathology results from the fish in the feeding test, although inconclusive, tended to support the trends which were developing in the contact test. There was an inverse proportional relationship between growth of fish in the feeding test and the amount of heptachlor introduced. The control group showed the highest growth rate, and the groups with progressively higher intake of heptachlor had progressively lower growth rates. (Authors)

8647. Lauer, Gerald J., H. Page Nicholson, William S. Cox, and John I. Teasley (Federal Water Pollution Control Admin., S.E. Water Lab., Athens, Ga.). 1966. PESTICIDE CONTAMINATION OF SURFACE WATERS BY SUGAR CANE FARMING IN LOUISIANA. Trans. American Fisheries Soc., 95(3): 310-316.

Agricultural, hydrological, and water quality studies were conducted in Louisiana during the years 1961, 1962, and in 1964 to determine the methods, extent, and duration of surface water contamination by endrin used in sugar cane agriculture. In 1961, a maximum of 360 parts per trillion (ppt) of endrin was recovered from water by carbon adsorption (sample volumes of 1,000 to 5,000 gallons). Endrin was recovered from each of the six streams sampled, indicating that its use resulted in contamination of adjacent streams. Three of the streams were sampled at sites of fish kills attributed to endrin. Endrin was also recovered from the water of treatment plants utilizing two of these streams as sources of supply. In 1964, use of a more efficient carbon adsorption sample size of 100 gallons resulted in a maximum recovery of 700 ppt endrin while up to 820 ppt were obtained from 1-gallon grab samples. Surface runoff from fields was the main source of endrin contamination. Largest recoveries from the streams occurred after the first precipitation and runoff following applications to the fields. After that amounts recovered dropped rapidly. Residuals of endrin persisting in the soil from one agricultural season to the next may contribute small quantities to the water whenever runoff occurs. In addition to endrin, pesticides not used in sugar cane agriculture including dieldrin, BHC, and DDT were recovered from surface waters. Concentrations of dieldrin up to 1,360 ppt, BHC to 73 ppt, and DDT to 24 ppt were recovered. (Authors)

8648. Ames, Warren E., R.M. Condie, and B. Pollara (Bur. Commercial Fisheries Biol. Lab., Seattle, Wash.). 1966. A METHOD FOR INTRAVASCULAR INJECTION AND BLEEDING OF FISHES. Trans. American Fisheries Soc., 95(3): 317-318.

8649. Jones, Benjamin F. (Bur. Commercial Fisheries, Juneau, Alaska). 1966. TWO NEW TOOLS FOR APPLYING DISK TAGS TO FISH. Trans. American Fisheries Soc., 95(3): 323-325.

8650. Ferguson, Denzel E., and C. Rex Bingham (Dept. of Zoology, Mississippi State Univ., State College, Miss.). 1966. ENDRIN RESISTANCE IN THE YELLOW BULLHEAD, Ictalurus natalis. Trans. American Fisheries Soc., 95(3): 325-326.

8651. Klein, W. D. (Dept. of Game, Fish and Parks, Denver, Colo.). 1966. MORTALITY OF TROUT CAUGHT ON ARTIFICIAL LURES AND RELEASED BY FISHERMEN. Trans. American Fisheries Soc., 95(3): 326-328.

8652. Lewis, Robert M., and Rupert R. Bonner, Jr. (Bur. Commercial Fisheries, Biological Lab., Beaufort, N. C.). 1966. FECUNDITY OF THE STRIPED BASS, Roccus saxatilis (Walbaum). Trans. American Fisheries Soc., 95(3): 328-331.

8653. Flemer, David A., and William S. Woolcott (Univ. of Maryland, Natural Resources Inst., Chesapeake Biological Lab., Solomons, Md.). 1966. FOOD HABITS AND DISTRIBUTION OF THE FISHES OF TUCKAHOE CREEK, VIRGINIA, WITH SPECIAL EMPHASIS ON THE BLUEGILL, Lepomis m. macrochirus Rafinesque. Chesapeake Science, 7(2): 75-89.

The food habits (1,733 individuals) and the distribution (2,056 individuals) of 9 families, 26 genera, and 32 species of fishes, were determined for Tuckahoe Creek, a lower piedmont tributary of the James River, Virginia. These species represent 41% of the freshwater fishes known for the entire river basin. Five species accounted for 69% of the collection: Etheostoma nigrum (20%), Lepomis macrochirus (18%), Hybopsis leptocephala (15%), Notropis cornutus (11%), and Aphredoderus sayanus (5%). Within the upper two-thirds of the creek there was a trend for the number of species to increase in a downstream direction. Stomach contents of 273 L. macrochirus were mainly insects (65%) and crustaceans (29%). Tendipedids and copepods were particularly important food items although the bluegill consumed a wide variety of animal forms. The selection was a probable reflection of the general availability of potential food. Young fish (0 and 1 age-groups) fed more often on microcrustaceans and dipteran larvae while older fish consumed a higher percentage of coleopterans and hymenopterans. Analysis of stomach contents of other centrarchids showed significant differences. Hemipterans dominated the diet of Centrarchus macropterus and were important food items for Chaenobryttus gulosus. Entomostracans formed the bulk of the diet of Enneacanthus gloriosus and decapods were eaten primarily by C. gulosus. The largest percentage of coleopterans was taken by Lepomis auritus. The cyprinids were represented by all types of feeders. Notropis cornutus was a true omnivore (feeding equally on plant and animal matter) and H. leptocephala selected a diet primarily of plant material. Dipteran larvae dominated the diet of the percid, E. nigrum (78% of total items) and the pirate perch, A. sayanus (53%). Gambusia affinis fed mainly on Hemiptera (34%). The catostomids consumed predominantly microscopic plants. Specimens of Esox niger less than 74 mm SL ate insects more often (48% as opposed to 16% in larger fish), whereas larger specimens fed on fishes (63% as opposed to 30% in the smaller forms). (Authors)

8654. Ruggles, C. P. (Dept. of Fisheries of Canada, Vancouver, British Columbia). 1965. JUVENILE SOCKEYE STUDIES IN OWIKENO LAKE, BRITISH COLUMBIA. Canadian Fish Culturist, Issue 36, December 1965. pp. 3-22.

The results of a four-year study of juvenile sockeye salmon abundance, distribution, growth rate and survival in various regions of a British Columbia coastal lake, along with data on water temperature, transparency and zooplankton abundance, are presented. Results indicate that an inverse relationship exists between population density of young salmon and their growth rate and survival. The density dependent nature of these relationships suggests that food and/or space act as a population control limiting smolt production in Owikeno Lake. No significant relationship was found between juvenile sockeye lacustrine growth or survival and zooplankton abundance. (Auth.)

8655. Lindroth, Arne (State Power Board and Bergeforsen's Hydro-Electric Co., Sweden). 1965. FIRST WINTER MORTALITY OF ATLANTIC SALMON PARR IN THE HATCHERY. Canadian Fish Culturist, Issue 36, December 1965. pp. 23-34.

The dependence of first winter mortality in Atlantic salmon in the hatchery on mean fish size and on crowding was studied on routine data for three winter seasons. Within the year-class mortality is largely determined by mean individual size of fish in the lots, whereas crowding has less or no significance within the ranges investigated. Between year-classes no such dependence was found. Apparently absolute size in itself does not necessarily determine first winter mortality, but size position within the group (year-class). A dual nature of size as factor of ecological importance is suggested. (Auth.)

8656. Posewitz, Jim. 1966. BIG CHANGE IN THE BIG POND. Montana Wildlife, July 1966, pp. 19-22.

A series of years of drawndown followed by several years of rising water inundating recently established vegetation created suitable spawning conditions for both northern pike and forage fishes in Fort Peck Reservoir. Current studies are aimed at determining what water level fluctuations should be sought to maintain a fishable population of pike in this reservoir.

8657. Anonymous. 1966. THE TEN POUND BROOK TROUT LIMIT. Montana Wildlife. July 1966, pp. 31-32.

Overpopulations of stunted brook trout develop in cold headwater lakes and streams which are lightly fished. With the recently liberalized poundage, regardless of numbers, it is hoped that such waters will attract more fishermen, provide a better harvest, and perhaps increase the growth and size of the remaining trout.

8658. Apmann, Robert P., and Maurice B. Otis. 1965. SEDIMENTATION AND STREAM IMPROVEMENT. New York Fish and Game Journal, 12(2): 117-126.

Changes in or adjustments of a stream channel, without protection of the stream geometry, can affect fish life. Stream channels are in delicate balance with their sediment loads and water discharges. Construction activities, including stream improvement, within a watershed, particularly those which encroach directly on a stream channel, must be based on a knowledge of stream behavior and sedimentation if unanticipated, detrimental changes in the shape and location of the channel are to be avoided. Valuable guidance regarding the effect of stream improvement designs may be derived from studying existing installations and correlating the circumstances involved with those in situations under consideration. (Authors)

8659. Burdick, G. E., H. J. Dean, E. J. Harris, Jack Skea, and David Colby (New York State Conservation Dept., Albany). 1965. TOXICITY OF SEVIN (CARBARYL) TO FINGERLING BROWN TROUT. New York Fish and Game Journal, 12(2): 127-146.

A comparative study was made of the toxicity of three preparations of Sevin to fingerling brown trout. Toxicity appeared to be bimodal. No significant difference was found between static and flow-through solutions. Sevin was found to be more toxic in aquaeous than in oil suspension after addition to water. It was also found to be less toxic in soft, acid water than in a harder, alkaline water. The effect of temperature was determined for a single concentration and is presented graphically. A precedure was established for comparing toxicity within modes, based on the theory that comparison of the means of the mode in which 50 percent mortality occurred in similar concentrations could be used to establish significant or nonsignificant variation between preparations. It was found that size had a positive relationship to time for death. Accordingly, adjustment to a uniform fish size, based on a determined average correction factor, was used to reduce variability in data caused by difference in size. Graphical estimation of the logarithmic probability$_{50}$ was used to establish the point of 50 percent mortality at each concentration. The antilog of the logarithmic probability$_{50}$ was plotted on

logarithmic paper to form the toxicity curve. The toxicity of 50W Sevin was found to be slightly lower than the value derived by combining the data for 85P and 99T Sevin. (Authors)

8660. Kelly, William H. (New York State Conservation Dept., Albany). 1965. A STOCKING FORMULA FOR HEAVILY FISHED TROUT STREAMS. New York Fish and Game Journal, 12(2): 170-179.

A formula was developed to calculate the results of various rates of stocking large-sized trout in terms of return to the angler using creel census data concerning the catch and fishing pressure. The formula was field tested with marked (fin-clipped) brown trout on Willowemoc Creek with promising results. It was also applied to data from Esopus Creek, Peekskill Hollow Creek and the East Branch of the Delaware River to illustrate how management recommendations based on it might vary. An important feature is that it relates directly to the performance of hatchery trout during the first season after stocking. It also permits assessing the contributions of the wild population and of carryover fish from previous stocking. The value of a mathematical approach is considered to lie not so much in producing precise figures as in providing measurements of the dynamics of the existing fishery that may be used to guide management policy. (Auth.)

8661. Schaefer, Richard H. (New York State Conservation Dept., Albany). 1965. AGE AND GROWTH OF THE NORTHERN KINGFISH IN NEW YORK WATERS. New York Fish and Game Journal, 12(2): 191-216.

Between August 1961 and July 1964, age and growth data were collected from approximately 2,700 northern kingfish sampled by several types of gear at various locations in the waters about Long Island, New York. Scale annuli were identified and, based on their locations on the scales and the time of formation, were considered to be valid indicators of age. Fish lengths were back-calculated and the average growth rates for males and females, as well as the length-weight relationship, were determined. The size and age composition of the catches by the different types of gear are presented and discussed. Some observations on age at maturity and mortality rates are included. (Auth.)

8662. Forney, John L. (Dept. of Conservation, Cornell Univ., Ithaca, N. Y.). 1965. FACTORS AFFECTING GROWTH AND MATURITY IN A WALLEYE POPULATION. New York Fish and Game Journal, 12(2): 217-232.

The age distribution of a spawning population of walleyes in Oneida Lake was determined from samples collected between 1946 and 1963. The proportion of age VI and younger fish in the run increased during recent years. Examination of walleyes in late fall indicated a trend toward earlier maturity which was associated with more rapid growth of the 1959 and 1960 year classes. From 1 to 16 percent of the adult females examined in late fall during the period 1959 to 1962 had failed to form eggs by October. Lengths at each annulus were calculated for samples collected from the spawning run and during the growing season using a straight-line relationship with an intercept of 2.28 inches. Growth of individual year classes appeared independent of their numerical size from 1952 to 1959. Annual changes in growth increment were more closely correlated with yearly fluctuations in abundance of young yellow perch than with annual temperature indices or the biomass of walleyes from 1957 to 1962. Rates of exploitation derived from angler tag returns were correlated with annual growth increments and suggested that vulnerability of walleyes to angling was high in years when food was scarce. (Auth.)

8663. Eipper, Alfred W., and John L. Forney (New York Coop. Fishery Unit, Cornell Univ., Ithaca, N. Y.). 1965. EVALUATION OF PARTIAL FIN CLIPS FOR MARKING LARGEMOUTH BASS, WALLEYES AND RAINBOW TROUT. New York Fish and Game Journal, 12(2): 233-240.

Removing the distal half to two-thirds of the pectoral or ventral fins of 12-inch and larger walleyes, and the pectoral fins of 6- to 7-inch largemouth

bass, produced a mark that was permanently and uniformly recognizable in the regenerated fin by a thickening and bending of rays along the excision line. Partial clips did not produce an easily recognizable mark on the ventral fins of these bass or on the pectoral, ventral, dorsal, or anal fins of 5-inch rainbow trout. It seems likely that the conspicuousness of the mark produced by partial clipping varies with the relative size of the fish when marked. As an adjunct to complete fin removal, partial clipping increases the number of groups of fish that can be distinctively marked at one time. Adverse effects of fin mutilation on survival and behavior are probably minimized because initial injury is less severe and partially clipped fins usually regenerate rapidly. Partial clipping is a fast marking procedure that requires almost no training and no special equipment other than a pair of diagonal wire-cutting pliers. (Authors)

8664. Jones, Rodney. 1966. MANUAL OF METHODS FOR FISH STOCK ASSESSMENT. PART 4. MARKING. FAO Fisheries Technical Paper No. 51, Suppl. 1. 90 p.

The use of marking data in fish population analysis. Discusses theory of tagging experiments for determination of population size, mortality and growth estimations and determination of dislocation. Demonstrates application of methods by examples.

8665. Andrews, C. W. (Dept. of Biology, Memorial Univ. of Newfoundland, St. John's, Nfld.). 1966. LANDLOCKED ATLANTIC SALMON (Salmo salar L.) IN THE TERRA NOVA RIVER SYSTEM, NEWFOUNDLAND. Canadian Field-Naturalist, 80(2): 101-109.

It was concluded that the landlocked salmon population of Newfoundland inland waters represent an angling resource which has been little utilized in the past. Its rate of growth in the Terra Nova River system, at least, where "pan sized" fish of 20 cm. (8 inches) or more is reached in from 3 to 4 years indicates that greater utilization, from a biological point of view, may be warranted.

8666. Stang, Joann C., and R. M. Cable (Dept. of Biological Sciences, Purdue Univ., Lafayette, Ind.). 1966. THE LIFE HISTORY OF Holostephanus ictaluri Vernberg, 1952 (Trematoda:Digenea), AND IMMATURE STAGES OF OTHER NORTH AMERICAN FRESHWATER CYATHOCOTYLIDS. American Midland Naturalist, 75(2): 404-415.

The cercaria of Holostephanus ictaluri develops in the snail, Lioplax subcarinata, and encysts in the minnow, Notropis cornutus. The adult occurs in the intestine of a catfish, and suggestions that it is not the natural definitive host are rejected for reasons that are discussed. Descriptions of the cercaria and metacercaria are given, and those stages of Linstowiella szidati and Prohemistomum chandleri are redescribed. The cercaria of Neogogatea kentuckiensis is figured, and diagnostic features of the five freshwater cyathocotylid cercariae reported from the United States are given in a table. Validity of P. chandleri is upheld, and Ambloplites rupestris, Pomoxis nigromaculatus and P. annularis are reported as new second intermediate hosts of that species. Transfer of L. szidati to the genus Paracoenogonimus is rejected, and N. pandionis is reduced to synonymy with N. kentuckiensis but Neogogatea may not be generically distinct from Gogatea. (Authors)

8667. Nordlie, Frank G. (Dept. of Zoology, Univ. of Florida, Gainesville). 1966. THERMAL ACCLIMATION AND PEPTIC DIGESTIVE CAPACITY IN THE BLACK BULLHEAD, Ictalurus melas (Raf.). American Midland Naturalist, 75(2): 416-424.

A study was carried out to determine whether the black bullhead demonstrates a compensating peptic digestive capacity influenced by thermal acclimation. Crude pepsinogen extracts from entire stomachs of two groups of fish were used. One group was acclimated to 12° C., the other group to 24° C. (all for more than 60 days). It was found that the extract from the group of fish acclimated to 24° C. showed higher peptic activity than that from the 12° C. acclimated fish. The high peptic activity in the 24° C. acclimated fish group seemed to represent a reversed

compensation. A slight difference between responses to substrate pH was observed. There were no detectable differences in temperature responses between the peptic extracts from the two laboratory-acclimated fish groups. It was concluded that black bullheads probably have greatest digestive capacity during the summer months. During the winter they most likely exist at reduced activity levels on stored fat and glycogen. (Auth.)

8668. Wydoski, Richard S., and Edwin L. Cooper (Dept. of Zoology, Pennsylvania State Univ., University Park, Pa.). 1966. MATURATION AND FECUNDITY OF BROOK TROUT FROM INFERTILE STREAMS. Jour. Fisheries Research Board of Canada, 23(5): 623-649.

The reproductive rate of brook trout populations from infertile Pennsylvania streams was determined. The standing crops for eight streams varied between 14 and 41 lb/acre. Trout in age-groups 0 through III were found to grow slowly with very few individuals reaching a total length of 6 inches. The seasonal development of ova was determined by measuring all ova larger than 0.2 mm from selected females. The maturing ova of most females of age-groups II and III increased in diameter from 0.9 mm in February to 1.0 mm in June, 1.75 mm in July, 2.5 mm in August, 3.0 mm in September, and 4.0 mm in October. Maturing females could be distinguished from immature females by late August or early September on the basis of ova diameters. The mean diameter of ripe ova from 67 females was 4.05 mm with a range between 3.37 and 5.01 mm for individual trout ranging from 4.6 to 8.6 inches total length. The relationship between the number of mature ova and the total length of the female for one population was described by a curvilinear regression ($\log Y = -0.5361 + 3.23 \log X$, where Y = number of eggs, and X = the total length of the fish) for brook trout between 3.6 inches (18 eggs) and 7.7 inches (213 eggs). Variation in this relationship existed among streams. Ova production was estimated as 9,050 ova per acre for one population and 13,620 ova per acre for another. Age-group-I females contributed approximately 9% of this production; age-group-II females, 54%; and age-group-III females, 37%. An ecological life table was constructed for two populations comparing rates of survival, age-specific fecundity rates, and reproductive rates. (Authors)

8669. Royer, L. M. (Saskatchewan Fisheries Lab., Saskatoon, Sask., Canada). 1966. BIOASSAY METHOD FOR THE DETERMINATION OF TOXAPHENE IN LAKE WATER. Jour. Fisheries Research Board of Canada, 23(5): 723-727.

A method based on static bioassays was developed to measure the concentration of toxaphene before restocking of lakes treated with this toxicant. A double distillation technique was used to extract the toxaphene and concentrate it in a small volume of distillate. Bioassays were then carried out in 200-ml samples of distillate reconstituted with electrolytes to match a standard water. Guppies, Lebistes reticulatus (Peters), less than 7 days old were used as test organisms. The method developed was used to follow the detoxification of Midway Lake which was rehabilitated with toxaphene. Data on the rate of detoxification are presented. (Auth.)

8670. Pearson, Roger E. (Bur. of Commercial Fisheries, Seattle, Wash.). 1966. NUMBER OF CIRCULI AND TIME OF ANNULUS FORMATION ON SCALES OF PINK SALMON (Oncorhynchus gorbuscha). Jour. Fisheries Research Board of Canada, 23(5): 747-756.

Mean numbers of circuli on scales of juvenile pink salmon collected along the coast of North America in 1964 increased from 1.7 on June 23 to 17.4 on September 10. On scales of adults collected from the eastern North Pacific Ocean from 1962 to 1965, mean numbers of circuli ranged from 24.1 on January 23 (1964) to 46.9 on September 2 (1962). The fork length at time of scale formation was approximately 60 mm. Mean fork length increased with the total number of circuli. The relationship of fork length to number of scale circuli showed some variation between stocks. The winter ring was present or was being formed on the majority of scales taken in late January. The development of the annulus varied considerably among individual fish. (Auth.)

8671. Black, Edgar C., Glenville T. Manning, and Koichiro Hayashi. 1966. CHANGES IN LEVELS OF HEMOGLOBIN, OXYGEN, CARBON DIOXIDE, PYRUVATE, AND LACTATE IN VENOUS BLOOD OF RAINBOW TROUT (Salmo gairdneri) DURING AND FOLLOWING SEVERE MUSCULAR ACTIVITY. Jour. Fisheries Research Board of Canada, 23(6): 783-795.

The effects of severe muscular exercise were studied in 1-1/2-year-old rainbow trout (Salmo gairdneri). Changes in the oxygen and carbon dioxide content of blood taken from the heart together with alterations in blood levels of pyruvate and lactate were followed in 14 separate conditions. Observations were also made on fish swimming steadily in a rotating annulus. (Authors)

8672. Betts, J. L., and G. G. Wilson (Research Labs., Fraser Companies, Ltd., Atholville, N. B., Canada). 1966. NEW METHODS FOR REDUCING THE TOXICITY OF KRAFT MILL BLEACHERY WASTES TO YOUNG SALMON. Jour. Fisheries Research Board of Canada, 23(6): 813-824.

Kraft pulp mill bleachery effluents and those from the unbleached screening operation were tested, separately and in combination in the proportions as they would exist in the main effluent of a particular mill, for toxicity to young Atlantic salmon, Salmo salar. The bleachery component from the chlorination stage, tested under neutral pH conditions, was considerably more toxic than the other components. Major reductions in the toxicity of the chlorination stage component were accomplished by treating it with small quantities of sulphur dioxide. Lesser but still appreciable toxicity reductions were observed in the whole effluent when the chlorination component was thus treated before combination with the other components. The toxicities of laboratory-produced filtrates from certain modified first-stage (chlorination) bleaching procedures were also evaluated. Notably, much less toxic filtrates resulted when substantial mixtures of chlorine dioxide and chlorine were substituted for the normal chlorine dosage in the first bleaching stage. A number of other treatments, methods, and their relative effectiveness are discussed. (Authors)

8673. Paloheimo, J. E., and L. M. Dickie (Fisheries Res. Bd. Canada Biological Station, St. Andrews, N. B., Canada). 1966. FOOD AND GROWTH OF FISHES. II. EFFECTS OF FOOD AND TEMPERATURE ON THE RELATION BETWEEN METABOLISM AND BODY WEIGHT. Jour. Fisheries Board of Canada, 23(6): 869-908.

In an earlier paper we described the growth of fishes, $\Delta W/\Delta t$, in relation to the experimentally measurable variables, body weight (W), food intake (R), and total metabolism (T). Here we review experimental evidence of the nature of the relation between T and W, and its dependence on R and temperature. Making use of the basic energy equation, $pR = T + \Delta W/\Delta t$, where p is the term for correction from injested to utilizable energy, we calculate T as the difference between the energy equivalents of R and $\Delta W/\Delta t$, for comparison with results of oxygen consumption studies. Application to a number of published experimental results suggests that with constant food availability, this index of total metabolism, T, derived from feeding experiments, shows the same rate of change with body weight, W, as has been found by oxygen consumption studies under standard conditions. That is, the two sources of data provide estimates of a common γ in the relation

$$T = \alpha W^{\gamma}$$

where α and γ are the fitted parameters for the curve. When fish are fed on a "maintenance" diet, the value of α calculated from the food-growth difference (the growth change is rarely nil in a given experimental observation period), appears to correspond with that characterizing the "routine" metabolic level in oxygen consumption studies. Higher α levels result from higher levels of food availability, and at ad libitum feeding α appears to approach the levels known in oxygen consumption studies as "active" metabolic levels. Temperature effects in the experiments were estimated from multiple regression analyses and showed an elevation of α with increasing temperature. The long-term effect of temperature on α was comparable with that predicted by the Krogh correction at ad libitum

feeding, but was significantly lower when food was limited, as at "maintenance" feeding. From a survey of effects of different designs of feeding experiments on these metabolic parameters, it appeared that apparently aberrant values of the weight exponent γ may instead be mistaken interpretations of changes in the level of metabolism α. That is, within the limiting conditions of standard or active metabolism, changes in temperature during experiments or manipulations of the availability of food by the experimenter, sometimes unintentionally, elicit adaptative responses in the level of metabolism, α. These show up in the results as effects on γ when the changes in conditions are gradual, hence confounded with body-size changes during growth. The ability to make distinctions between effects of various factors on these two metabolic parameters appears to depend upon a distinction between experiments designed to explore what fish are capable of doing. The former type reveal a remarkable conservatism in the basic relation between metabolism and body size, γ. Results from the latter reflect possibilities of metabolic adaptation to environmental circumstances. The apparent predictability of the response of the total metabolism to various conditions of food energy supply and dissipation suggests that the remainder of the energy system, represented by the growth, may be similarly predictable. If this is true outside the laboratory, measurements of the metabolic parameters, α and γ, already familiar in physiological and behavioural research, could be directly used as indices of the (relative) positions of various sizes and species of fish in natural production systems. (Authors)

8674. Power, Geoffrey, and Gilles Shooner (Quebec Dept. of Tourism, Fish and Game, Quebec, Canada). 1966. JUVENILE SALMON IN THE ESTUARY AND LOWER NABISIPI RIVER AND SOME RESULTS OF TAGGING. Jour. Fisheries Research Board of Canada, 23(7): 947-961.

Morphometric and hydrographic conditions indicated Nabisipi River, Quebec, has a fjord-type estuary with warm surface water of low salinity flowing out over cold saline water from the Gulf of St. Lawrence at all phases of the tidal cycle. The age, weight, and condition factors of 231 juvenile salmon from the estuary and 200 from the lower reaches of the river are given. Ages ranged from 1+ to 4+, condition factors (100 X weight in grams divided by the length in centimeters cubed) were slightly below 1.0 in the river and slightly higher in the estuary. Amphipods and capelin eggs were important constituents in the diet in the estuary, Corixidae in the river. Tagging indicated a growth rate of about 0.8 mm/day in the estuary. Both tagging and the handling of marked fish retarded growth. Tagging retarded growth for approximately 20 days. Tagging returns indicated a population of between 700 and 2,500 fish near the mouth of the estuary in June and July 1961. These were thought to be remnants of the spring smolt run. In addition there was a small resident population of salmon parr living in the estuary. Numbers of fish in the estuary changed considerably from year to year. (Authors)

8675. McCrimmon, Hugh, and Wen-Hwa Kwain (Dept. of Zoology, Univ. of Guelph, Guelph, Ontario, Canada). 1966. USE OF OVERHEAD COVER BY RAINBOW TROUT EXPOSED TO A SERIES OF LIGHT INTENSITIES. Jour. Fisheries Research Board of Canada, 23(7): 983-990.

Fingerling and yearling trout (Salmo gairdneri Richardson) responded differently when exposed to a series of artificial daylight illuminations. Fingerling trout showed no apparent response to the overhead cover, being randomly distributed at all light intensities. Yearling trout, except in total darkness, exhibit a positive response to the overhead cover, but their pattern of behaviour differed with the light intensity and the positioning of the cover. (Authors)

8676. Gibson, R. John, and Miles H. A. Keenleyside (Dept. of Zoology, Univ. of Western Ontario, London, Ontario, Canada). 1966. RESPONSES TO LIGHT OF YOUNG ATLANTIC SALMON (Salmo salar) AND BROOK TROUT (Salvelinus fontinalis). Jour. Fisheries Research Board of Canada, 23(7): 1007-1024.

Responses of young Atlantic salmon (Salmo salar L.) and of brook trout (Salvelinus fontinalis Mitchill) to different levels of illumination and to overhanging

and submerged cover were compared in the laboratory. At surface illuminations between 0.4 and 160 ft-c trout were either slightly photopositive or showed no preference for light or dark areas, while salmon were photopositive. At illuminations above 300 ft-c both species were photonegative when the light area had a smooth, unbroken substrate. Under these conditions starvation induced salmon into the light, but trout remained photonegative, although slightly less so than well-fed trout. With submerged cover (plants, broken flowerpots, etc.) in the light area, salmon were strongly photopositive, while trout were photonegative. Salmon were less photopositive, but still preferred the light area, with submerged cover in both dark and light areas. In most experiments trout maintained position at the edge of the shadow caused by overhead cover, looking out into the light area from the dark. The significance of these results to habitat segregation by the two species where they are sympatric in nature is discussed. (Authors)

8677. Allen, George H. (Div. Natural Resources, Humboldt State College, Arcata, Calif.). 1966. OCEAN MIGRATION AND DISTRIBUTION OF FIN-MARKED COHO SALMON. Jour. Fisheries Research Board of Canada, 23(7): 1043-1061.

Migration, distribution, and movement of five groups of fin-marked coho salmon of the 1950 brood planted into Puget Sound, Washington, in 1952, were followed during 1952 and 1953 by a study of 847 recoveries of marked salmon taken in sport and commercial fisheries in the Pacific Ocean, Puget Sound, and closely adjoining regions. Differences in migration, distribution, and movements of the five groups of salmon were correlated with the time, place, and method of planting. The most pronounced difference in behavior was shown by salmon receiving an extra 2 months of rearing in the hatchery as compared with other groups. This group was marked by removal of the dorsal and right ventral fins. A lag in average time of migration to points in the ocean and a tendency to migrate lesser distances while in the ocean characterized the behavior of these fish. This lag in time of migration as indicated by patterns of recovery of marked salmon from sport and commercial fisheries was confirmed by an actual lag in time of return to the point of release. In migrating from off the coast of Washington to Puget Sound, the salmon moved at an estimated rate of 5-7 nautical miles per day. (Auth.)

8678. Jenkinson, D. W., and K. Sutherland (Fisheries Research Board of Canada, Biological Station, Nanaimo, B. C., Canada). 1966. A PORTABLE PRESS FOR MAKING IMPRESSIONS OF SALMON SCALES. Jour. Fisheries Research Board of Canada, 23(7): 1089-1093.

8679. Nelson, J. M. (The Nature Conservancy, Moor House Field Station, Garrigill, Alston, Cumberland, England). 1965. A SEASONAL STUDY OF AERIAL INSECTS CLOSE TO A MOORLAND STREAM. Jour. of Animal Ecology, 34(3): 573-579.

From the spring thaw to the end of the year 17,525 aerial insects were caught by a sticky trap technique over the surface and on the bank of the stream. Diptera, including 89 determined species, accounted for 96% of the catch. Over three times as many Diptera were caught over the stream as on the bank, this excess being due mainly to Chironomids and Empidids. (Auth. summ.)

8680. Hawkins, A. D., and C. J. Chapman. 1966. UNDERWATER SOUNDS OF THE HADDOCK, Melanogrammus aeglefinus. Jour. Marine Biological Assoc. United Kingdom, 46(2): 241-247.

It has not been known with certainty that the haddock produces underwater sounds of biological significance, though various authors have suggested the possibility. Descriptions are given of sounds (grunts and rasp-like noises) produced in particular behavioural contexts by haddock maintained in tanks, and of sounds recorded at sea and attributed to haddock. Oscillograms and a spectrogram of these sounds are given. It is suggested that the sounds are involved in aggression and self-defense. The sound-producing mechanism is described. (Authors)

8681. U.S. Fish and Wildlife Service, Washington, D.C. 1965. THE EFFECTS OF PESTICIDES ON FISH AND WILDLIFE, 1964. U.S. Fish and Wildlife Service Circular 226, 77 p.

This is the fifth report on expanded studies on the effects of pesticides upon fish and wildlife resources. It summarizes pesticide research by the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. Much of the earlier work was concerned with the field evaluation of pest control operations, improvements in analytical techniques, and the measurement of residue levels in fish and wildlife species collected from or near sprayed areas. The present report reflects an increasing effort to determine the physiological effects of pesticides, particularly those related to reproduction and survival under conditions encountered in the natural environment. The findings present additional evidence of the almost universal presence of chlorinated hydrocarbon insecticide residues in ecosystems. Biological magnification of these chemicals in the food chain and effects upon fish and wildlife are topics of high research priority.

8682. Kearn, G.C. (School of Biological Sciences, Univ. of East Anglia, Norwich). 1966. THE ADHESIVE MECHANISM OF THE MONOGENEAN PARASITE Tetraonchus monenteron FROM THE GILLS OF THE PIKE (Esox lucius). Parasitology, 56(Pt. 3): 505-510.

The monogenean parasite Tetraonchus monenteron attaches itself to the gills of the pike (Esox lucius) by means of two pairs of large hooks (= hamuli). One pair of hooks is directed ventrally and the outer (flanking) pair is directed dorsally so that the hooks impale two adjacent secondary gill lamellae. Each lateral pair of hooks (one ventral and one dorsal hook) is operated by a single extrinsic muscle, the tendinous region of which is threaded through two fibrous loops (= pulleys), one attached to each hook. Each tendon on entering the haptor also passes beneath transverse fibres joining the anterior ends of the two ventral hooks and these fibres probably act as a third pulley. This complex pulley system has a high mechanical advantage so that the energy used by the parasite to hold its hooks in position against the strong gill ventilating current of the host is minimal. The mechanics of the adhesive apparatus of T. monenteron are compared with those of the monogenean gill parasite Amphibdelloides maccallumi, in which the pulley system is less complex. (Auth. summ.)

8683. Chapman, D.W. (Idaho Cooperative Fishery Unit, Univ. of Idaho, Moscow). 1966. FOOD AND SPACE AS REGULATORS OF SALMONID POPULATIONS IN STREAMS. American Naturalist, 100(913): 345-357.

For stream-dwelling, natural populations of salmonids, all the foregoing can be forged into one grand speculation. The physical environment only legislates the density and does not react to the biological aspects; thus, setting the framework within which density is governed. Some biological aspects of environment have the characteristics necessary for governing density. In some cases, competition for spawning sites may limit density; more usually, seeding is adequate and the control of density occurs at later stages in life history. Predation, cannibalism, pathogens, and parasites act usually as agents of destruction. Interspecific competition in stream fish acts more as a density-legislative factor than as a density-governing one because of specific habitat isolation brought about by current velocity, bottom type, cover, and time. In summer each species is regulated in density by a space-food, sometimes by a space-shelter, mechanism. In the former case competition for space (contest) has been substituted for conventional competition for food (scramble), but the substitution is incomplete, permitting populations to make use of temporarily superabundant food. A minimal spatial requirement appears to be present regardless of food supply and perhaps has been fixed over the evolutionary time scale by minimal food supply. If density is regulated in the winter, it probably is related to space necessary to escape downstream displacement or damage by current. (Auth. summ.)

8684. Longhurst, A.R., A.D. Reith, R.E. Bower, and D.L.R. Seibert (Inst. of Marine Resources and Scripps Inst. Oceanography, San Diego, Calif.). 1966.

A NEW SYSTEM FOR THE COLLECTION OF MULTIPLE SERIAL PLANKTON SAMPLES. Deep-Sea Research, 13(2): 213-222.

A new plankton sampler is described which employs the Hardy principle to collect plankton from a half-meter zooplankton net; the strips of filtering gauze are advanced by an electric drive every 30 sec so that a series of discrete samples of this duration, each representing the filtrate from about 20 m^3 of water, is collected. The flow through the mouth of the net, and the temperature and depth range during each sampling period, are recorded on the paper chart of a miniature electronic recorder simultaneously with the collection of plankton samples. The entire system and its power supply are contained in a single underwater vehicle towed on an ordinary non-conducting wire cable. The capability of the model described is about one hour's sampling to a maximum depth of 680 m; in a double oblique tow two samples are obtained, one descending and the other ascending, each comprising about 50 discrete samples representing depth intervals of about 10 m. Sampling may be extended either temporally or spatially with minimal modifications and patchiness may be investigated in any desired sense, be it horizontal, oblique, or vertical. (Authors)

8685. Emery, K.O., and Boris Shekhvatov (Woods Hole Oceanographic Inst., Woods Hole, Massachusetts). 1966. BATHYMETRIC CHARTS OF MAJOR PARTS OF THE PACIFIC OCEAN, AND THE NEW SOVIET CHART OF THE PACIFIC: A REVIEW. Deep-Sea Research, 13(2): 235-239.

A brief description is given of the charts of the Pacific Ocean that have been published in various countries after World War II. These charts have become progressively better as the number of soundings has increased. Latest is a new bathymetric chart of the entire Pacific Ocean compiled by G. B. Udintsev and his associates at the Institute of Oceanology, Academy of Science, U.S.S.R. It has a 500-meter contour interval for the sea floor and land (plus a — 200 and a + 200-meter contour), and it has color tints for most contour intervals. Soundings from all available sources are incorporated: expeditions of Soviet oceanographic ships and those of other countries, plus data from hydrographic charts of many countries. The topography presented by the chart is more realistic than that shown by most other charts of the Pacific Ocean (Monaco, Japanese, U.S. Navy — world map), owing to the denser sounding network and the better cartography. Only the contours of the large-scale chart of the northwestern Pacific Ocean by Hess and of the general chart of the Pacific by Menard are comparable, and only the hachures and symbols on the large-scale chart of the north-eastern Pacific Ocean by Menard yield a clearer impression of physiographic details. (Authors)

8686. Rupp, Robert S. (Maine Dept. Inland Fisheries and Game, Orono). 1966. GENERALIZED EQUATION FOR THE RATIO METHOD OF ESTIMATING POPULATION ABUNDANCE. Jour. of Wildlife Management, 30(3): 523-526.

A number of previously described methods of population estimation which are based on changes in relative abundance of two classes of individuals in a population are really one method which can be presented as one basic equation. The algebraic derivation of the equation is presented, along with examples of population estimation problems which demonstrate its usefulness in many situations. (Auth.)

8687. Welch, Eugene B., and Robert C. Ball (Dept. of Fisheries and Wildlife, Michigan State Univ., East Lansing). 1966. FOOD CONSUMPTION AND PRODUCTION OF POND FISH. Jour. of Wildlife Management, 30(3): 527-536.

Consumption by pond fish and the associated fish-flesh production by populations of different densities, species, and individual size were studied in two ponds during three summers. Benthos consumption was estimated by measuring the benthic biomass inside and outside of wire fish exclosures, in the absence and presence of fish predation, respectively. When a mixed population of bluegills (Lepomis macrochirus), pumpkinseeds (L. gibbosus), green sunfish (L. cyanelus), and bullheads (Ictalurus melas), was increased in density from 77 to 141 kg/hectare, consumption of benthos increased. Fish production also increased, but not in proportion to consumption. At density 315 kg/ha, consumption appeared much

reduced and fish production was negative. A population of sunfish less than 127 mm long produced 0.70 $g/m^2/wk$ of fish-flesh and consumed a substantial quantity of benthos; but a population of longer fish, in a section of the same pond and at the same initial density (190 kg/ha), showed a negative production and no benthos consumption. Results with other species were less clear. A bass (Micropterus salmoides) population at the same initial density produced only 0.04 $g/m^2/wk$, with no apparent benthos consumption. A bullhead population (same density) showed low fish-flesh production and high benthos consumption, indicating that at that density most of the energy was required for maintenance. We conclude that exclosures have merit in studying food-chain relationships, but results are influenced by (1) lengthy sampling intervals and high benthic productivity that mask the consumption by fish, (2) predation by benthic organisms upon one another, and (3) size, density, and species of fish. (Authors)

8688. Beatty, D. D. (Dept. of Biology, Univ. of Oregon, Eugene). 1966. A STUDY OF THE SUCCESSION OF VISUAL PIGMENTS IN PACIFIC SALMON (Oncorhynchus). Canadian Jour. of Zoology, 44(3): 429-455.

Retinae of Pacific salmon (Oncorhynchus) have mixtures of two visual pigments, one a retinene$_1$ (VP 503_1) and the other a retinene$_2$ pigment (VP 527_2). Retinal extracts were prepared from individuals of five species collected at different times of the year. These extracts were subjected to partial bleaching experiments to determine the proportions of the two visual pigments. Liver extracts were prepared and the percentages of vitamin A_1 and vitamin A_2 were estimated in these extracts by means of the Carr-Price (antimony trichloride) colorimetric reaction. There was a progressive increase in the percentage of VP 527_2 in retinae of adult coho, king, pink, chum, and sockeye salmon during the spawning migration. Except for the sockeye salmon, this increase resulted in a conversion from a retina having predominantly VP 503_1 to one having a preponderance of VP 527_2. Juvenile coho and king salmon exhibited changes in the proportions of the two visual pigments during the year, but similar changes did not occur in juvenile sockeye salmon. The percentage of VP 527_2 in the retina is not a simple function of the proportion of vitamin A_2 in the liver of adult salmon which accompanied the increase in the proportion of VP 527_2. (Auth.)

8689. Straškraba, Milan, Jiří Čhiař, Stanislav Frank, and Václav Hruška. 1966. CONTRIBUTION TO THE PROBLEM OF FOOD COMPETITION AMONG THE SCULPIN, MINNOW AND BROWN TROUT. Jour. of Animal Ecology, 35(2): 303-311.

From an investigation in the trout-zone of the Morávka stream, results were obtained showing a differentiation of the niches from which the three commonest co-existing species of fish obtained their food. The brown trout takes larger animals that move freely or sit upon the bottom, the minnow feeds on smaller animals inhabiting the bottom surface or plants, and the sculpin obtains its food from under stones and among gravel. There was thus little evidence of competition for food among these species. This is contrary to the conclusion generally accepted in the literature from data which, in most instances, have been too limited to be conclusive. (Authors summ.)

8690. Kamoto, Mitsurusa (Water Research Lab., Faculty of Science, Nagoya, Univ., Nagoya, Japan). 1966. PRIMARY PRODUCTION BY PHYTOPLANKTON COMMUNITY IN SOME JAPANESE LAKES AND ITS DEPENDENCE ON LAKE DEPTH. Archiv für Hydrobiologie, Band 62, Heft 1. pp. 1-28.

The relation between the photosynthetic production of phytoplankton and depth of lake was examined based on the theoretical figures obtained by calculation. During circulation periods, in shallow eutrophic lakes the production is maintained in high level by sufficient supply of nutrient salts, while in deep mesotrophic or oligotrophic lakes, it is limited by scarcity of nutrient salts and unfavourable light condition in lake water, because the depth of mixing layer is deeper than the compensation depth. In summer, the production of phytoplankton in shallow eutrophic lakes is somewhat limited by an unfavourable light condition in the water due to

high population density. In the deep stagnated lakes in summer, on the contrary, the production may be strongly restricted by less supply of nutrient salts in the euphotic zone. (Auth. summ.)

8691. Hibbert, Delvan D. 1966. FISHING FOR THE CISCO. Idaho Wildlife Review, 18(4): 3-6.

A history of the fishery of Bear Lake with emphasis on the harvesting of the Bonneville cisco by nets during January and February.

8692. Wedemeyer, Gary (Fish-Pesticide Research Lab., Bur. Sport Fisheries and Wildlife, Denver, Colo.). 1966. UPTAKE OF 2,4-DICHLOROPHENOXY-ACETIC ACID BY Pseudomonas fluorescens. Applied Microbiology, 14(4): 486-491.

Factors influencing the uptake of the sodium salt of 2,4-dichlorophenoxyacetic acid (2,4-D), under conditions in which no net metabolism occurred, were investigated in an effort to determine both the significance of "non-metabolic" uptake as a potential agent in reducing pesticide levels and the mechanisms involved. Uptake of 2,4-D was affected by pH, temperature, and the presence of other organic and inorganic compounds. Uptake was more pronounced at pH values less than 6, which implies that there may be some interaction between charged groups on the cell and the ionized carboxyl group of 2,4-D. Active transport, carrier-mediated diffusion, passive diffusion, and adsorption were considered as possible mechanisms. Though uptake was inhibited by glucose, sodium azide, and fluorodinitrobenzene (but not by uranyl ion), 2,4-D was not accumulated against a concentration gradient, a necessary consequence of an active transport system, nor was isotope counterflow found to occur. Thus, carrier-mediated diffusion was finally precluded, implying that uptake probably occurs by a two-step process: sorption onto the cell wall followed by passive diffusion into the cytoplasm. (Auth.)

8693. Damurat, Jerzy (Fish Biology and Physiology Dept., College of Agriculture, Olsztyn, Poland). 1956. EMBRYONIC DEVELOPMENT OF TROUT (Salmo trutta L.), PIKE (Esox lucius L.) AND ROACH (Rutilus rutilus L.) IN WATERLESS ENVIRONMENT. Polskie Archiwum Hydrobiologii, 3(16): 166-173. Translated from Polish. Avail. from U.S. Dept. of Commerce, Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151. TT 65-50370. Pr. $1.00.

Artificially fertilized eggs of trout (Salmo trutta L.), pike (Esox lucius L.), and roach (Rutilus rutilus L.), were transferred to paraffin oil on reaching the stage of first blastomeres and embryonic development of the above fishes was found to be possible in the paraffin oil at a temperature ranging from 9° to 14° C. Hatching of embryos in paraffin oil took place in the case of roach only. All of the eggs of the trout and pike kept in paraffin oil perished at the time of hatching of the control embryos. (Auth. summ.)

8694. Kawamura, Teruyoshi (Faculty of Fisheries, Hokkaido Univ., Hakodate, Hokkaido, Japan). 1966. DISTRIBUTION OF PHYTOPLANKTON POPULATIONS IN SANDY HOOK BAY AND ADJACENT AREAS IN RELATION TO HYDROGRAPHIC CONDITIONS IN JUNE 1962. Bureau of Sport Fisheries and Wildlife Technical Paper 1, Wash., D.C. 37 p. Charts.

8695. Yamazi, Isamu (Seto Marine Biological Lab., Kyoto Univ., Japan). 1966. ZOOPLANKTON COMMUNITIES OF THE NAVESINK AND SHREWSBURY RIVERS AND SANDY HOOK BAY, NEW JERSEY. Bureau of Sport Fisheries and Wildlife Technical Paper 2, Wash., D.C. 44 p. Charts.

8696. Della Croce, Norberto (Inst. of Zoology, Univ. of Genoa, Genoa, Italy). 1966. OBSERVATIONS ON THE MARINE CLADOCERAN Penilia avirostris IN NORTHWESTERN ATLANTIC WATERS. Bureau of Sport Fisheries and Wildlife Technical Paper 3, Wash., D.C. 13 p. Charts.

8697. Regan, Danny M. (Colorado Coop. Fishery Unit, Colorado State Univ., Ft. Collins). 1966. ECOLOGY OF GILA TROUT IN MAIN DIAMOND CREEK IN NEW MEXICO. Bureau of Sport Fisheries and Wildlife Technical Paper 5, Wash., D. C. 24 p.

Data on Gila trout (Salmo gilae) ecology were collected from a 2 1/2-mile section of Main Diamond Creek in New Mexico, in the upper range of the Transition Zone (approximately 8,000 feet). Between June 7 and November 1, 1962, stream flow ranged from 175 to 423 gallons a minute; water temperature was 43° to 60° F. Chemical characteristics were comparable to those of other tributaries in the same altitude range. Total fish population in Main Diamond Creek was estimated at 4,300, representing age groups I through VI. The Gila trout is the only fish in the upper part of Main Diamond Creek. Growth rate for this species was much slower than for three other trout species in the Gila River drainage. There was a steady decline in condition factor from June to November 1962. Analysis of bottom fauna and stomach samples showed little variation between utilization and occurrence. Trichoptera, Ephemeroptera, Diptera, and Coleoptera were the most important food items. A high incidence of scale regeneration and subsequent variability resulted in inadequate body-scale relations. Meristic and morphometric characters for 25 Gila trout were approximately the same as those for paratypes collected 25 years ago. (Auth.)

8698. Finnell, Larry, and W. D. Klein. 1966. COLORADO'S SILVER SALMON. Colorado Outdoors, 16(4): 15-16.

Some 68,000 fingerling coho salmon were stocked in Granby Reservoir in 1963. Their survival and growth for the first 2 years were so satisfactory that stocking of 100,000 more was scheduled for 1966. Coho salmon were also planted in Parvin Lake, but their growth was not as rapid as rainbow trout. Most of them attempted to migrate downstream over the surface outlet, but were recovered in the outlet trap and returned to the lake. It appears that the coho salmon may prove a beneficial addition in Granby Reservoir, but it is not expected to be of value in impoundments or lakes having a surface outlet.

8699. Lennon, Robert E. (Fish Control Lab., Bur. Sport Fisheries and Wildlife, La Crosse, Wis.). 1966. ANTIMYCIN — A NEW FISHERY TOOL. Wisconsin Conservation Bulletin, 31(2): 4-5.

A new fish toxicant shows promise in carp control, for it kills carp more readily than most fish and in the concentrations used appears harmless to other animal life. Because much remains to be learned about optimum dosages, application techniques, and usefulness, the Wisconsin Conservation Commission has entered into a $60,000 contract for research to test Antimycin thoroughly in selected waters during 1966 and 1967.

8700. Northcote, T. G., and H. W. Lorz. 1966. SEASONAL AND DIEL CHANGES IN FOOD OF ADULT KOKANEE (Oncorhynchus nerka) IN NICOLA LAKE, BRITISH COLUMBIA. Jour. Fisheries Research Board of Canada, 23(8): 1259-1263.

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